

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Issued December 23, 1911.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF STATISTICS—BULLETIN 88.
VICTOR H. OLMSTED, Chief of Bureau.

THE COST OF PRODUCING MINNESOTA
DAIRY PRODUCTS, 1904-1909.

BY

THOMAS P. COOPER,

*Assistant in Farm Management, Minnesota Agricultural Experiment
Station, Special Agent, Bureau of Statistics, United States
Department of Agriculture.*



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1911.

ORGANIZATION OF BUREAU OF STATISTICS.

Statistician and Chief: VICTOR H. OLMSTED.

Associate Statistician: NAT C. MURRAY.

Assistant Statistician: SAMUEL A. JONES.

Chief Clerk: FRANK G. KELSEY.

Division of Domestic Crop Reports: FRED. J. BLAIR, *Statistical Scientist in Charge.*

Division of Production and Distribution: GEORGE K. HOLMES, *Statistical Scientist in Charge.*

Division of Research and Reference: CHARLES M. DAUGHERTY, *Statistical Scientist in Charge.*

Crop Reporting Board:

VICTOR H. OLMSTED, chairman, NAT C. MURRAY, GEORGE K. HOLMES; two or more persons called in from the corps of special field agents and State statistical agents.

Issued December 23, 1911.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF STATISTICS—BULLETIN 88.
VICTOR H. OLMSTED, Chief of Bureau.

THE COST OF PRODUCING MINNESOTA
DAIRY PRODUCTS, 1904-1909.

BY

THOMAS P. COOPER,

*Assistant in Farm Management, Minnesota Agricultural Experiment
Station, Special Agent, Bureau of Statistics, United States
Department of Agriculture.*



WASHINGTON
GOVERNMENT PRINTING OFFICE.
1911.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF STATISTICS,
Washington, D. C., April 1, 1911.

SIR: I have the honor to transmit herewith, and to recommend for publication as Bulletin No. 88 of this bureau, a report upon the cost of producing dairy products on Minnesota farms. This is a continuation of a series of bulletins on the cost of producing farm products in Minnesota, of which Nos. 48 and 73 have been issued.

This bulletin is based on investigations carefully carried out on three groups of farms in Minnesota by the Bureau of Statistics, Department of Agriculture, in cooperation with the Division of Agriculture of the Minnesota Agricultural Experiment Station. Statistics on the cost of producing the staple northwestern farm crops, together with a careful explanation of the methods of procedure, were published in earlier bulletins.

This bulletin has for its object the presentation of data showing the cost of dairy products on farms operated under normal conditions, also the items of cost analyzed in detail and the various economic factors which enter into and influence the cost of production. The discussion is chiefly on the economics of the industry as found and determined on these groups of farms rather than from the viewpoint of production.

Respectfully yours,

VICTOR H. OLMSTED,
Chief of Bureau.

HON. JAMES WILSON,
Secretary of Agriculture.

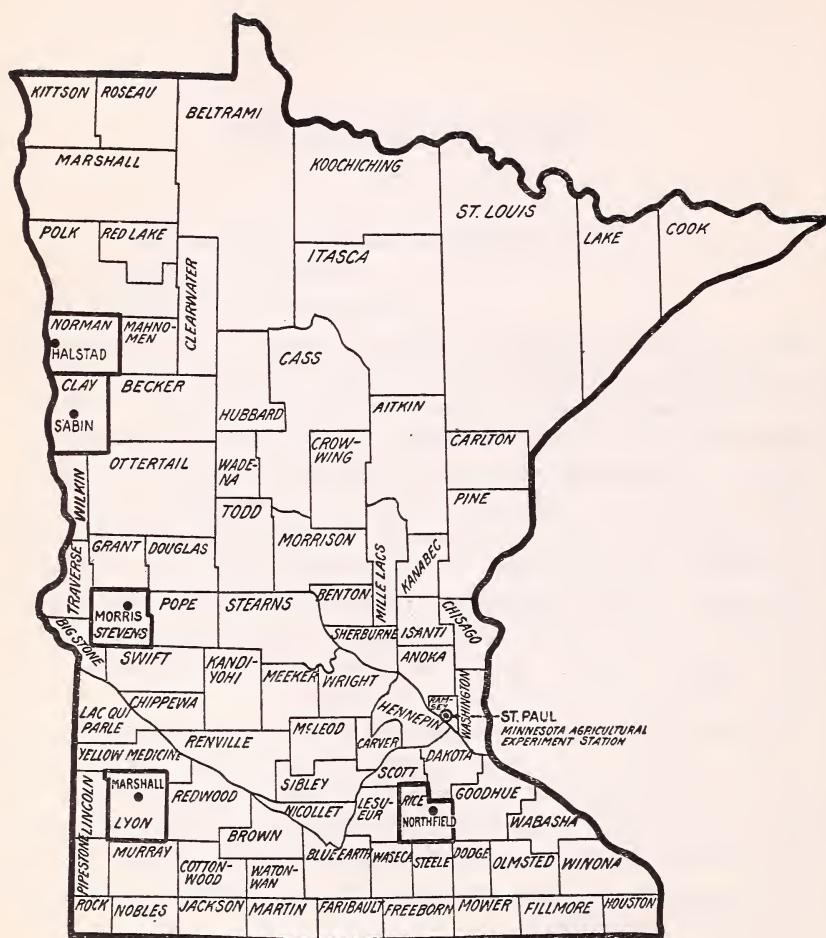


FIG. 1.—Localities in which statistics were obtained.

At each of the stations, Halstad, Marshall, and Northfield, is located a joint agent of the United States Department of Agriculture and of the Minnesota Agricultural Experiment Station, who visits eight farms each day and secures reports of labor, sales, purchases, and other data necessary to keep a double-entry set of books concerning the business and concerning all costs of production. Each of these agents lives for three days a month on each of the eight farms on his route, and weighs the feed given to all classes of live stock, as well as the milk of dairy cows. He also samples the milk for testing. The location of each place in which statistics have been gathered is shown on the State map above.

ACKNOWLEDGMENTS.

The following gentlemen have served as special agents of the Minnesota Agricultural Experiment Station and the Bureau of Statistics of the United States Department of Agriculture for collecting the statistics on agricultural production embodied in this bulletin: Messrs. E. C. Parker, H. H. Mowry, H. G. Krum, F. B. Headley, W. A. Peck, J. W. Schneider, Thomas Cooper, H. R. Danielson, Earl Hacking, William McKenzie, John Gregor, Harvey M. Bush, George McClelland, Edwin Mayland, W. I. Peterson, Harold Greaves, Charles D. Stewart, H. P. Brandt, Charles Matthews, C. L. McNelly, and John Gore.

Assistance given by Profs. Andrew Boss and A. D. Wilson in reviewing and editing this work is acknowledged.

The thanks of the Department of Agriculture, the Minnesota Experiment Station, and the author are due the following farmers who have cooperated in this investigation:

Northfield (Rice County): W. H. Holden, Nicholas Lamberty, John Melvin, John Linster, John and James Bruce, W. E. Chester, John Miller, John Morrison, Patrick Heffernan, Will Heffernan, Edward Heffernan, Samuel Kennedy, Charles O. Nichols, John Clifford, Charles E. Taylor, George Taylor, Fred Hibbard, George Lyman, Simon La Point, James Sheridan, Hyland Taylor, Robert A. Whitson, Charles Drentlaw, George Miller, and I. N. Festler.

Marshall (Lyon County): B. and Henry Snyder, Henry E. Meehl, J. W. Pike, W. E. Heagle, Henry Preston, Vernon Tubbs, C. J. Spong, John and F. Fligge, Rasmus Nelson, C. C. Rock, Charles Middleton, Fred Marks, John Spong, John Myhrvold, Herman Marks, H. J. Newhouse, D. M. Moore, Homer N. Robinson, Freese Brothers, Fred Elhers, James Andrews, and Boyd Reese.

Halstad (Norman County): Henry Henderson, I. L. Houske, J. K. Hage, Martin Rasmusson, Matt Rasmusson, Oscar Olson, Halvor Helgeson, Knute Olson, B. O. Hellerud, Joseph Henderson, Sivert Viig, Anthony Sheie, Nels Enger, L. J. Enger, John Gunderson, Knute Haugen, Edward Salverson, A. Stennes, J. Hellerud, A. Asrrestad, Hans P. Olson, Oscar Carlson, Nels H. Nelson, R. I. Steen, A. O. Sandvold, Simeon Rasmusson, Sven Carlson, C. L. Sulerud, John Sulerud, L. W. Pederson, Martin Arneson, Edward T. Stennes, Henry Holte, Aslak Hanson, L. H. Houske, and Marius Sether.

CONTENTS.

	Page.
Introduction.....	11
General information as to field covered and methods used.....	12
Methods of collecting and compiling the data.....	12
Period of time covered.....	14
Number of farms.....	14
Type and kind of cattle kept and nature of business on each route.....	14
Average size of farms and average number of cattle on each.....	16
TABLE I.—Average area of farms, average number of cows and other cattle per farm, and average acreage per cow.....	16
Factors in the cost of maintaining a cow.....	17
Methods of determining cost.....	17
Labor.....	17
Man labor.....	17
TABLE II.—Rate of wages per hour (including cost of board) for man labor hired by the month.....	17
Horse labor.....	18
TABLE III.—Cost of horse labor per hour.....	18
Feeds.....	18
TABLE IV.—Average farm price of feeds at stations named, 1904-1909.....	19
Pasture.....	20
TABLE V.—Number of days pasture afforded annually by an acre of ground.....	21
General expense.....	21
Machinery and equipment.....	22
Cost of shelter.....	22
Average annual cost of shelter.....	23
Depreciation.....	23
Herd bulls.....	25
Interest on investment.....	25
The cost of milk or butter-fat production.....	25
Food consumption per cow.....	26
TABLE VI.—Average annual food consumption per cow.....	27
TABLE VII.—Total food consumption per 100 pounds of milk produced	27
Hours of man and horse labor required in care of cow.....	28
TABLE VIII.—Hours of man and horse labor required annually in care of cow.....	28
Product per cow.....	29
TABLE IX.—Average production of milk and butter fat per cow.....	29
Cost of maintenance of a cow.....	29
TABLE X.—Annual cost of maintenance of a cow.....	30
Proportion of the cost of each item of operating expense to the total cost of operation.....	31
TABLE XI.—Percentage of items of cost of maintenance to total main- tenance.....	32

The cost of milk or butter-fat production—Continued.	Page.
Cost of production of whole milk and butter fat.....	33
TABLE XII.—Cost of production of whole milk per hundredweight and of butter fat per pound.....	35
Cost of product compared with price received.....	36
TABLE XIII.—Average annual cost of producing butter fat at Halstad and whole milk at Northfield, compared with average prices received.	37
Total annual income or earnings per cow from all sources.....	38
TABLE XIV.—Average annual income per cow from milk products.....	40
Relation of cost of maintenance and income.....	40
The season of milk production.....	41
Application of cost statistics to methods of management.....	43
Effect of increased production on cost per unit of product.....	43
TABLE XV.—The effect of increased production of milk in diminishing the cost of its production.....	44
Cost of production and its relation to profitable yields.....	45
TABLE XVI.—Annual cost of maintenance of cows of different values and quantity of milk at \$1.20 per 100 pounds required to cover cost of main- tenance.....	46
TABLE XVII.—Value of cows of high and low yields with milk at \$1.20 per 100 pounds.....	47
Economic position of the dairy in relation to the farm.....	48
TABLE XVIII.—Average cash income per farm from dairy products and sales of cows and miscellaneous cattle.....	49
TABLE XIX.—Total cash sales per farm, total sales per farm from dairy cattle, and percentage to total sales.....	50

APPENDIX.

Financial statement of miscellaneous cattle.....	53
Northfield, 1905-1909.....	54
Marshall, 1906-1909.....	58
Halstad, 1904-1909.....	60
Detailed financial consumption and production accounts for dairy enterprise..	64
TABLE XX.—Food consumption and production of milk and butter fat, by months.....	65
Northfield, 1905-1909.....	65
Marshall, 1906-1909.....	66
Halstad, 1904-1909.....	67
Financial statement of dairy cattle.....	69
Northfield, 1905-1909.....	70
Marshall, 1906-1909.....	75
Halstad, 1904-1909.....	79

ILLUSTRATIONS.

	Page.
PLATE I. A productive dairy herd at Northfield	16
II. A productive dairy herd at Halstad.....	16

TEXT FIGURES.

FIG. 1. Map of localities in which statistics were obtained.....	4
2. Itemized expenditure of each dollar for maintenance at Halstad.....	32
3. Itemized expenditure of each dollar for maintenance at Marshall....	33
4. Itemized expenditure of each dollar for maintenance at Northfield..	33
5. Relation of annual cost of maintenance and income per cow. All routes, 1904-1909.....	34
6. Average cost of producing milk per 100 pounds and price received, Northfield, 1905-1909.....	37
7. Average cost of producing butter fat per pound and price received, Halstad, 1904-1909.....	37
8. Average yield of milk per cow, by months, Halstad, 1904.....	41
9. Average yield of milk per cow, by months, Northfield, Halstad, and Marshall, 1907.....	41
10. Average yield of milk per cow, by months, Northfield and Halstad, 1905	41
11. Average yield of milk per cow, by months, Northfield, Halstad, and Marshall, 1906.....	42
12. Average yield of milk per cow, by months, Northfield, Marshall, and Halstad, 1909.....	42
13. Average yield of milk per cow, by months, Northfield, Halstad, and Marshall, 1906.....	42

THE COST OF PRODUCING MINNESOTA DAIRY PRODUCTS, 1904-1909.

INTRODUCTION.

So marvelous has been the growth of manufacture and transportation during the past half century, so striking the contrast between the world's commerce to-day and that of even 50 years ago, so concentrated the activities of manufacture and trade, that it has become customary to look for examples of great industrial development only in large cities. But to those who have watched and furthered the cause of agriculture in its tardy awakening, recognizing it to be the most important because the most fundamental of the great industries, the development of business methods in farming and its inseparable interests, and in the management of land and crops, has during that period been quite as remarkable and as deeply fraught with meaning as the growth of manufacture and commerce. Particularly true is this of dairying, which, as an enterprise of the farm, has become through scientific methods one of the profitable forms of agriculture.

Investigations of proper methods of feeding and of compounding rations have placed the feeding of dairy cows on a basis which is particularly exact. Scientific invention has given the world methods by which the daily productivity of a cow may be accurately determined and her value as a producer learned at any time. The care and shelter required for a cow used for dairy purposes has become a subject of popular interest, and every farmer and cow owner knows at least the advantage of the care which should be given an animal used in dairy production. In fact, because of the important position the cow holds in the economy of the farm, a propaganda has for years been conducted in favor of better and more advanced methods of care and feeding; as a result dairying is more nearly upon a factory basis than any other enterprise of the farm.

In furthering the industry and placing it upon a more economical basis, enabling consumer to obtain a uniform product and producer to turn out one of high quality and value, the manufacture of the raw material has in most cases been transferred from the household to factories, where butter and cheese are manufactured by skilled

men. Development along economic lines and consequent betterment of product have had a great effect upon the dairy industry. Cooperative creameries and cheese factories, selling associations, and other organizations have been most potent in the rise of industry and in the education of the producer in the use of profitable as well as sanitary methods.

In this work Minnesota has been one of the foremost, so that a detailed investigation of the economic conditions of the dairy industry on a group of Minnesota farms should, by comparison, shed much light on the conditions that probably prevail in similar leading dairy sections of the United States.

Little attention has heretofore been given this industry in its relation to the farm as a whole, or in its economic relations, notwithstanding the fact that much attention has been devoted to methods of production, feeding, and care. The investigation reported in this bulletin had for its purpose the determination of cost of production in detail, and the relation of that cost to the product and income therefrom. The object has been to show the exact status of the dairy industry and the cost of dairy products to the producer, endeavoring to deduce therefrom the economic principles that govern the industry. The bulletin presents actual conditions during specified years.

GENERAL INFORMATION AS TO FIELD COVERED AND METHODS USED.

In presenting the data, the endeavor has been to put it upon a basis which will be most useful to men actually engaged in farming, to supply fundamental data as to costs such as could be obtained only through a series of years of cooperative effort. Certain general information is necessary in regard to the methods of collection, the time over which the investigation extended, the number of farms, type, and kinds of cattle kept, and the average size of the farms and number of cattle thereon. All of these affect more or less the status of the herds investigated and the application which may be made of the results.

METHODS OF COLLECTING AND COMPILING THE DATA.

Bulletin 48, Bureau of Statistics, Department of Agriculture, entitled "The Cost of Producing Minnesota Farm Products," by Hays and Parker, 1906, contains a detailed account of the methods employed in collecting statistics of cost. In Bulletin No. 73, same series, by Parker and Cooper, published in 1909, a partial statement was made of methods used in collection of cost data of live stock, particularly of the dairy industry. The following discussion of

methods is given, therefore, only in a condensed form and applies particularly to the phase of the investigation under discussion. The work was started in 1902 in cooperation with three communities of farmers in typical agricultural regions of Minnesota, namely, at Northfield (Rice County), in southeastern Minnesota; Marshall (Lyon County), in southwestern Minnesota; and Halstad (Norman County), in northwestern Minnesota. Each is a typical agricultural community, and represents a different phase of agricultural development and progress. In the vicinity of Northfield the farms are well developed and dairying is the most important industry. Near Marshall, agriculture is in transition from grain growing to live-stock production, while at Halstad grain growing is the prominent feature, comparatively little attention being paid to live stock, although in the past 5 years considerable interest has been exhibited in dairying.

Previous to 1904 the principal object of the investigation had been to obtain the cost of grain production, but since that time production of all classes of farm products has been studied and an endeavor made to ascertain costs and formulate methods of determining them. Since 1904 an accurate book account of each farm has been kept, with the object of recording detailed statistics of costs and of the profits or losses arising from each enterprise of the farm, and from the farm as a whole. The data in this bulletin embodies detailed statistics of the dairy enterprise, as segregated from all other enterprises on the farm.

From 8 to 10 farms were selected in each community, as representative of average conditions in their respective localities, to cooperate in this work, the purpose being to cooperate with farmers who cared for their stock by usual methods rather than to select exceptionally successful men who were more progressive than the average farmer.

A "route man," employed as a special agent, was stationed in each community and visited each farm therein daily, obtaining a complete report as to the number of hours of man and horse labor spent on every operation in the various farm enterprises, the amount of sales and expenditures, and all items relative to crop or live-stock production.

Land, live stock, machinery, feed, grain, and all forms of farm equipment were inventoried at the beginning and close of each year, so that all cost and depreciation could be accurately determined. A part of three days out of every month was spent by the route man on each farm, during which period the grain and roughage fed to each class of live stock was weighed and the milk of each dairy cow weighed and tested. The data as to weight of feeds and products are therefore based upon weights taken three days each month. In other words, these weights have been used as a basis for determining the

quantities fed and produce used for the entire month. To guard against error this has been checked by inventories of feed and cash purchases and by accurate records of sales and of farm produce used in the household.

By this method every detail of expense and receipt of the farm is recorded, and each enterprise thereon has received its proper credit or charge.

A simple double-entry system of accounts has been kept for each farm, which are balanced at the end of each calendar year. All work has been supervised from the Minnesota Experiment Station and the accounts kept there.

PERIOD OF TIME COVERED.

Cost data, beginning with 1904 and continuing until the present time, have been kept on all routes by methods previously described. However, owing to errors, or in many cases to the omission of small items in the original reports, the results for 1904 at Northfield and for 1904 and 1905 at Marshall have not been used. The results of a complete investigation at Halstad is presented, 1904 to 1909, inclusive; at Northfield, 1905 to 1909, inclusive; and at Marshall, 1906 to 1909 inclusive.

NUMBER OF FARMS.

Eight to ten farms were on each statistical route each year, making a total of 22 to 27 farms upon which data were kept. On a few of the farms there was, strictly speaking, no farm dairy enterprise, the character of the dairying being such that the costs could not properly be included in making averages. In many cases, the figures cover the same farms for the full period specified; hence, the record is a continuous one of practically the same farms for several years. Beginning 1906, cooperation with several farms at Halstad was discontinued and they were replaced by others; a similar change was made at Marshall in 1908. Practically no changes have been made at Northfield. In compiling, the data for all farms have been combined and averaged, no farm having retained its individuality. The results represent averages of groups and not results from any one farm.

TYPE AND KIND OF CATTLE KEPT AND NATURE OF BUSINESS ON EACH ROUTE.

Northfield is in an excellent dairy section, this industry affording the principal source of income. Situated within 40 miles of St. Paul and Minneapolis, it has for several years been noted as a center for Holstein cattle. At present most of the cows on the farms are

of this breed; when the investigation began, however, no particular breed was preeminent, the native cow and the Shorthorn being most common. For several years a large proportion of the milk has been sold in the cities as whole milk, although at times when prices or other conditions were unsatisfactory it has been manufactured into butter at the local cooperative creamery. Prices of dairy products have been higher on this route than on either of the others.

The farms in the vicinity of Marshall are grain and corn farms, although a considerable number of live stock is kept on each; dairying is of minor importance, hogs and beef cattle being the principal kinds of live stock. The cows used in the dairy show considerable Shorthorn blood, although other breeds are represented in limited numbers. Although fed abundantly, they do not have as good care or as comfortable stabling as at Northfield. The milk product not used on the farm is sold as butter fat at the local creamery.

Halstad, situated midway, north to south, of the Red River Valley, is in an essentially grain-growing section, engaged largely in the production of wheat. A very small proportion of the income is obtained from the dairy, and, until lately, this enterprise was considered merely a side issue. Cows were kept principally for the purpose of consuming the abundant roughage and pasturage on the farms, which otherwise would be wasted. At present much more attention is paid to the dairy industry and it is developing rapidly. Many excellent herds are being started. No particular breed is represented, the native cow with an admixture of Shorthorn blood predominating. The Guernsey, as typical of the strictly dairy breeds, is being used to some extent. The product is sold at the local cooperative creamery in the form of butter fat. On account of distance from markets, the prices paid for the products and also for feed are lower than at Northfield.

The three districts are probably fairly typical of the State and results obtained in them may reasonably be applied to any other similar section of the State. Although there is no question that the average production per cow on the three routes is somewhat higher than the average for the State,¹ and observation indicates that the care given dairy cows on the routes is doubtless above the average. Expressed in percentages the dairies represented in the investigation are probably 10 to 15 per cent more efficient than the average in their vicinity, although the effort was to choose as representative ones as possible.

¹ Prof. T. L. Haecker, Chief Division of Animal Industry, University of Minnesota, estimates the average production of butter fat per cow in the State in 1910 to be 142 pounds. The average production of milk was 3,750 pounds.

AVERAGE SIZE OF FARMS AND AVERAGE NUMBER OF CATTLE ON EACH.

During the period under consideration the average acreage of the farms at Northfield was 169.15 acres, at Marshall 309.19 acres, and at Halstad 501.71 acres. However, a larger acreage than this has been farmed each year, for in many cases land has been rented and farmed in connection with the home farm. However, it is considered that the essential feature is the relationship of cattle owned and kept to the acreage actually owned, as the rented land is operated for only a year or two at the most and principally for the production of grain, a part of which goes to the owner of the rented land. Obviously, such a system of land rental would not, to any great extent, affect the number of dairy cattle maintained on the home farm. The average acreage of the farms at Halstad is increased by the fact that a large grain farm of about 1,800 acres is included in the figures given. Excluding that, the average farm at Halstad was 282.29 acres.

The average number of cows and other cattle per farm during the same period was: Northfield, 14.8 cows, 9.9 other cattle; Marshall, 9.4 cows, 16.8 other cattle; and Halstad, 9.3 cows and 14.2 other cattle. Eliminating the large farm at Halstad the average farm at that center carried 11.2 cows and 14.1 other cattle.

TABLE I.—Average area of farms, average number of cows and other cattle per farm, and average acreage per cow.

Item.	Northfield.	Marshall.	Halstad.	
			Small farm.	Large farm.
Average area of farms.....acres..	169.15	309.19	282.29	1,891.4
Average cows per farm.....number..	14.8	9.4	11.2	7.4
Average other cattle ¹ per farm.....do....	9.9	16.8	14.1	14.3
Average acreage per cow.....acres..	11.4	32.9	25.2	.....

¹ "Other cattle:" Calves, yearlings, 2-year-olds, bulls not used in breeding, etc., but not cattle brought in especially for fattening purposes. Other cattle at Marshall include a few fattened at the farm and sold for beef.

Special attention is called to the fact that the number of "other cattle" per farm is very low on the Northfield route and comparatively high on the others. The fact has had direct influence upon profits from the cattle enterprise of the stations as a whole. At Northfield the calves are for the most part sold young, usually for veal, at a price which pays for the cost of fattening. The young stock retained are either used in the dairy or sold for breeding purposes. At Marshall and Halstad there is little sale for veal and seldom at remunerative prices. All young stock is carried until 2 or 3 years old and then sold as feeders, stockers, or for slaughter, generally at prices insufficient to pay the cost of raising.



A PRODUCTIVE DAIRY HERD AT NORTHFIELD.



A PRODUCTIVE DAIRY HERD AT HALSTAD.

FACTORS IN THE COST OF MAINTAINING A COW.

METHODS OF DETERMINING COST.

Factors entering into the cost of producing milk, though consisting of many different items, may be definitely divided into the following classes: Labor of man and horse, feeds, depreciation, cost of shelter, general expense, interest on investment, and use of machinery in equipment. These factors represent the actual cost of the maintenance of a herd on the farm.

LABOR.

MAN LABOR.

The two classes of labor used in the dairy are man labor and horse labor. In cost data all labor performed in the care of the cattle has been charged to that enterprise at the current rate of wages on the farms.

The rate of wages per hour is based upon the employment of hired men, and is obtained by dividing the aggregate monthly cash wages paid plus the aggregate cost of board by the aggregate number of hours' work performed each month. This gives a base figure of cost per hour upon which all wages are calculated for any enterprise. Table II shows the average rate of wages per hour, by months and routes, used in computing the total cost of man labor on all farms.

NOTE.—For further discussion see Bulletins No. 48 and No. 73, Bureau of Statistics, United States Department of Agriculture. It may be argued by some that much of the labor engaged in the care of the cow is performed by the proprietor or members of his family, hence does not represent a cost. While it is true that in some sections a large part of the labor is performed by the family, yet when the dairy is considered as a business or an accurate cost of production is to be obtained, the family must be credited at the current rate of wages for all labor performed and the cattle must be charged for the same.

TABLE II.—*Rate of wages per hour (including cost of board) for man labor hired by the month.*

Month.	Northfield.					Marshall.				
	1905	1906	1907	1908	1909	1905	1906	1907	1908	1909
	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
January.....	10.97	11.07	10.18	10.64	12.80	9.50	10.34	9.91	13.54	14.40
February.....	12.18	12.37	10.73	11.04	12.15	8.40	11.19	10.37	17.05	13.65
March.....	9.78	9.62	10.88	19.21	11.24	10.90	9.45	10.11	14.39	11.80
April.....	11.02	11.97	14.06	13.41	15.55	11.20	11.27	14.43	12.61	14.35
May.....	12.18	12.43	14.70	13.27	14.46	11.00	12.50	13.47	12.58	15.27
June.....	11.95	12.39	15.67	13.46	14.66	12.20	11.69	13.90	12.68	16.50
July.....	12.00	12.41	14.91	13.76	13.75	13.00	13.15	13.11	11.92	13.31
August.....	11.47	11.66	13.60	13.91	14.84	13.50	10.65	12.84	13.08	14.48
September.....	11.39	11.48	15.67	14.19	15.94	16.20	13.80	12.78	14.29	14.41
October.....	11.44	11.77	14.07	14.31	15.47	15.50	12.64	13.93	15.54	14.21
November.....	11.80	12.68	12.95	15.85	16.14	13.50	12.93	15.02	14.78	15.13
December.....	9.47	10.92	12.88	13.79	11.90	11.90	10.51	14.53	17.61	16.93

TABLE II.—*Rate of wages per hour (including cost of board), etc.*—Continued.

Month.	Halstad.				
	1905	1906	1907	1908	1909
	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
January.....	10.52	11.58	10.42	11.77	13.11
February.....	10.80	12.82	10.79	15.29	14.09
March.....	8.75	11.69	13.86	16.31	14.00
April.....	13.07	12.80	8.73	12.55	13.78
May.....	12.22	12.12	11.14	12.47	12.43
June.....	12.80	11.83	13.23	16.42	13.34
July.....	13.39	11.27	11.22	14.50	12.94
August.....	13.02	10.96	12.01	13.68	13.53
September.....	12.50	10.78	12.01	13.14	13.42
October.....	10.75	10.79	10.88	13.26	13.18
November.....	14.13	11.22	14.18	12.63	15.25
December.....	10.54	9.00	11.65	11.58	14.09

HORSE LABOR.

The horse is used to only a limited extent in the dairy, principally in marketing the product and hauling feeds. The cost of horse labor per hour at each station is determined by dividing the average annual cost of maintenance by the average number of hours each horse works during the year. The cost per hour thus obtained is then charged against the enterprise according to the number of hours of horse labor it receives.

TABLE III.—*Cost of horse labor per hour.*¹

Station.	1904	1905	1906	1907	1908	1909
	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
Northfield.....	8.33	8.52	9.13	11.02	12.05	9.64
Marshall.....	8.95	7.16	8.31	9.02	8.89	9.94
Halstad.....	7.27	6.72	7.62	7.67	8.69	8.72

¹ For complete discussion of cost of horse labor, see Bulletin 73, Bureau of Statistics, or Bulletin 117, Minnesota Experiment Station.

FEEDS.

The cost of feed contributes to the cost of maintenance and to the final cost of the product. Low prices for roughage and concentrates and high prices for product mean profit; while with high-priced foodstuffs and low prices for product profits are materially lessened.

In this investigation, all feeds consumed by cattle have been charged at the farm price, not at the cost of production. The farm price of farm-grown feeds is the market price less the cost of transportation from the farm to the nearest regular market. To illustrate, if barley is 45 cents per bushel at the market where the farmer sells his grain and the cost of transportation from farm to market is 1½ cents per bushel, the farm price would be 43½ cents per bushel. However, when roughage or concentrates are purchased, the cost of hauling to the farm is then charged to the cost of maintenance of the stock to which it is fed.

When feeds have no market price, as is frequently the case with corn fodder, millet hay, shredded stover, root crops, silage, etc., the cost is based upon the feeding value as compared with that of hay

or food which has a market value. These computations are based upon the tables of feeding values and methods prepared by Prof. T. L. Haecker of the Minnesota Experiment Station.

TABLE IV.—Average farm price of feeds at stations named, 1904–1909.

Station.	1904					
	Hay.	Fodder.	Barley.	Oats.	Spelt.	Bran.
	<i>Per ton.</i>	<i>Per ton.</i>	<i>Per bush.</i>	<i>Per bush.</i>	<i>Per bush.</i>	<i>Per ton.</i>
Northfield.....						
Marshall.....						
Halstad.....	\$3.57	\$2.266	\$0.293	\$0.25	\$0.271	\$14.00

Station.	1905							
	Hay.	Fodder.	Eared fodder.	Stover.	Barley.	Oats.	Corn.	Oil meal.
	<i>Per ton.</i>	<i>Per ton.</i>	<i>Per ton.</i>	<i>Per ton.</i>	<i>Per bu.</i>	<i>Per bu.</i>	<i>Per bu.</i>	<i>Per cwt.</i>
Northfield.....	\$5.85	\$3.00	\$5.00	\$1.90	\$0.33	\$0.241	\$0.33	\$15.66
Marshall.....	3.46	4.72			.337	.23	.323	\$1.73
Halstad.....	3.39	2.01			.207	.212		

Station.	1906							
	Hay.	Fodder.	Stover.	Barley.	Oats.	Corn.	Bran.	Oil meal.
	<i>Per ton.</i>	<i>Per ton.</i>	<i>Per ton.</i>	<i>Per bush.</i>	<i>Per bush.</i>	<i>Per bush.</i>	<i>Per ton.</i>	<i>Per cwt.</i>
Northfield.....	\$5.82	\$4.16	\$1.66	\$0.329	\$0.26	\$0.34	\$18.35	\$1.26
Marshall.....	3.32	3.28	2.07	.299	.25	.287	13.57	
Halstad.....	3.95	2.28		.21	.222		14.02	

Station.	1907									
	Hay.	Fodder.	Stover.	Silage.	Eared fodder.	Barley.	Oats.	Corn.	Bran.	Oil meal.
	<i>P. ton.</i>	<i>P. ton.</i>	<i>P. ton.</i>	<i>P. ton.</i>	<i>P. ton.</i>	<i>P. bu.</i>	<i>P. bu.</i>	<i>P. bu.</i>	<i>P. ton.</i>	<i>P. cwt.</i>
Northfield.....	\$7.91	\$5.04	\$2.03	\$1.80	\$7.27	\$0.443	\$0.357	\$0.416	\$18.04	\$1.671
Marshall.....	5.547	4.057	2.40			.384	.349	.394	18.32	
Halstad.....	4.17	2.76		1.50			.395		16.42	

Station.	1908									
	Hay.	Fodder.	Stover.	Silage.	Eared fodder.	Barley.	Oats.	Corn.	Bran.	Oil meal.
	<i>P. ton.</i>	<i>P. ton.</i>	<i>P. ton.</i>	<i>P. ton.</i>	<i>P. ton.</i>	<i>P. bu.</i>	<i>P. bu.</i>	<i>P. bu.</i>	<i>P. ton.</i>	<i>P. cwt.</i>
Northfield.....	\$7.61	\$5.29	\$2.42	\$1.78		\$0.527	\$0.437	\$0.526	\$22.29	\$1.67
Marshall.....	5.04	3.95	3.14		\$6.24		.404	.472	21.65	1.244
Halstad.....	4.49	3.53		1.76			.391		18.91	

Station.	1909									
	Hay.	Fodder.	Stover.	Silage.	Eared fodder.	Barley.	Oats.	Corn.	Bran.	Oil meal.
	<i>P. ton.</i>	<i>P. ton.</i>	<i>P. ton.</i>	<i>P. ton.</i>	<i>P. ton.</i>	<i>P. bu.</i>	<i>P. bu.</i>	<i>P. bu.</i>	<i>P. ton.</i>	<i>P. cwt.</i>
Northfield.....	\$5.00	\$3.81	\$1.52	\$1.89	\$6.00	\$0.511	\$0.358	\$0.559	\$23.00	\$1.65
Marshall.....	4.97	4.25	2.05				.379	.493	23.31	1.76
Halstad.....	4.71	3.08		1.50	5.00		.325		18.35	

The prices (Table IV), in so far as possible, are based upon actual market prices and are the average annual prices used in this bulletin in charging food consumed by the live stock. They are not the mean of monthly prices of products for the year, but the true average for the year. This is obtained by dividing the total sum charged for each product for the year by the total product fed. Thus the prices in the table represent the average for each food used, based upon actual quantities fed and the total value for the calendar year.

During the period 1904-1909 a decided advance in prices occurred. The effect upon cost of production and upon that of consumption is accurately registered year by year in the various aspects of the cost.

The roughage fed to cows on the route farms was principally tame hay (timothy and clover), corn fodder, and silage. Wild hay composed a minor part of the roughage ration. Corn, oats, and barley were the principal farm grains fed. Oats and barley or oats and corn were the favorite combination except when the price of oats was very high.

PASTURE.

Pasture has been charged at a uniform rate on all routes, the charge being based upon that for pasturage of live stock in those localities. This price is more or less arbitrary and is not based upon cost of pasturage, but upon the basis which is commonly accepted as fair in each locality. At Northfield cows were charged \$1 per head per month; 2-year-olds, 75 cents; yearlings, 50 cents; and calves, 25 cents. At Marshall cows and 2-year-olds were charged at the rate of 75 cents, yearlings at 50 cents, and calves at 25 cents per month. The charges at Halstad were the same as at Marshall.

The importance of pasturage in the economy of the farm is illustrated by the small quantity of grain or roughage fed during the pasture season. Appendix III shows that for practically five months out of each year the cattle were supported almost entirely from the grass crop. During this time the production, as shown by figures 8, 9, 10, 11, 12, and 13, was greater than at any other time of the year.

The area of land devoted to pasturage is 34.86 acres on the average farm at Northfield, 39.42 acres at Marshall, and 59.94 acres at Halstad; 20.6, 12.7, and 11.9 per cent, respectively, of the total area owned. Little use was made of early spring or late fall catch crops to extend the pasture period; the aftergrowth of meadows was used to a limited extent, principally at Northfield, where the fields are better fenced.

As a small part of the land used for pasture is low, or otherwise untillable, considerable areas being of no value whatever because of standing water, the amount of feed afforded and the income produced therefrom are remarkable.

Pastures at Northfield are all tame grass, principally timothy, or rotations of timothy and clover; at Marshall timothy, with a small area of wild native grass; and at Halstad practically all timothy.

Where all classes of live stock are pastured on the same field it is difficult to ascertain exactly the amount of pasturage an acre affords. Table V shows the number of days' pasturage per acre for each class of stock on the average farm.

TABLE V.—*Number of days' pasture afforded annually by an acre of ground.*

Station.	Average pasture area per farm.	Pasture per acre for—		
		Cows.	Other cattle.	Horses.
	<i>Acres.</i>	<i>Days.</i>	<i>Days.</i>	<i>Days.</i>
Northfield ¹	34.86	80.5	33.4	10.5
Marshall ²	39.42	44.2	60.4	28.5
Halstad ³	59.94	28.1	33.5	10.2

¹ Averages, 1905-1909.

² Averages, 1906-1909.

³ Averages, 1904-1909.

Table V gives the approximate amount of pasturage each acre of ground annually affords under conditions on these farms. The figures do not necessarily represent the maximum potential pasturage, but the amount actually obtained. A 2-year-old heifer will consume presumably as much as a cow, a horse as much as a cow, and a yearling two-thirds as much as a cow; expressing the number of days' pasture for "other" cattle in terms of pasture for cows, an acre of pasture on the average farm at Northfield affords 113.3 days' pasture, at Marshall 113 days' pasture, and at Halstad 60.6 days' pasture per cow.

GENERAL EXPENSE.

Many expenditures of cash and labor on the farm can not properly be charged in toto to any one enterprise, but must be distributed among all the productive enterprises. Telephone expenses, taxes, and insurance, time spent in hiring help, and many other items necessary to the general operation of the farm are in this category. The sum of these items is termed "general expense" and is distinguished from the sundry cash account in that the latter represents cash expenditures directly chargeable to a specific enterprise, while the former comprises items of cash and labor which should be distributed among all productive enterprises.

The method of distributing the general expense account has been as follows: Taxes and insurance were apportioned on the basis of the comparative capitalization of each productive enterprise; cash and labor in proportion to the comparative amount of labor performed on each productive enterprise. Productive enterprises, it

may be noted, are those operated for a profit or loss and which must finally pay the operating expenses of the farm and the profits.

This method of final distribution of the general expense account has been found very satisfactory, based, as it is, upon quality homogeneous to all enterprises. As insurance (paid) and taxes have been charged and distributed through the general expense account, these items have, for the purpose of this bulletin, been omitted from the cost of shelter, a separate item charged against the dairy.

MACHINERY AND EQUIPMENT.

In order to carry on the dairy operations, an ample equipment is needed to care for and market the product. On the station farms, equipment and machinery have generally consisted of cream separators, cans, pails, and miscellaneous dairy supplies. The annual charge for the use of this equipment consists of depreciation, repairs, and interest.¹ The charges made in this bulletin are for actual equipment on the farms from year to year.

COST OF SHELTER.

The cost of shelter can be estimated only approximately. All barns upon the routes shelter both horses and cattle and certain amounts of grain and roughage to be used for feed. They were built at different periods and the cost of construction varied. Few are new and few data are at hand to show the rate of depreciation and the cost of repairs or maintenance. The average barn on all routes sheltered approximately 40 head of mature stock—horses and cattle—and was valued, partly on its insurable and partly on an estimate of its present value, at \$1,500.

The method of ascertaining cost of shelter adopted was on the basis of the number of mature stock sheltered irrespective of the cubical space occupied. For example, if 40 head of stock were sheltered, 10 of which were horses, the horse enterprise was charged with one-fourth and the cattle with three-fourths of the cost. This method has been found satisfactory because of the arrangement of stock in the barns and of the fact that under ordinary Minnesota conditions all feeds stored in the barns are for the purpose of feeding rather than sale. Therefore, there was no reason for apportioning costs of shelter for storage of grains or roughage.

The cost of shelter is the sum of the following annual charges: Interest on capital invested, depreciation, insurance, taxes, and repairs. The average investment for shelter per farm was \$1,500, and an interest charge of 6 per cent annually was made upon the average depreciated value. Depreciation was calculated at the rate

¹ See Bulletin 73, Bureau of Statistics.

commonly accepted by underwriters for frame structures, viz, 2½ per cent annually, thereby allowing a 40-year life for a frame building. Repairs based on the average on farms investigated were estimated at \$15 annually. No charge was made for taxes, as they have been distributed among the various enterprises as a part of the general expense account.

The total annual cost of shelter on this basis is as follows:

Average annual cost of shelter.

Interest on depreciated average investment (\$768.75) at 6 per cent----	\$46.12
Depreciation, annually -----	37.50
Insurance (charged in general expense)-----	(¹)
Repairs -----	15.00
Taxes (charged in general expense)-----	(¹)
<hr/> Total -----	<hr/> 98.62
Average annual cost per head, based on sheltering the average number of 40 -----	2.46

Interest charges at Halstad are higher than at either Northfield or Marshall, but as the barns are somewhat more valuable at Northfield, it is considered equitable to make a fixed charge per head which will be charged on all routes.

DEPRECIATION.

A cow used in the dairy depreciates in value from year to year, her productive life being shortened with length of service. Her maximum money value, based upon her productivity, is probably reached at the age of 4 to 6 years. From that time she decreases in value, except in cases of pure-bred animals used for breeding purposes. Depreciation is due either to actual decrease in productivity because of advancing age, or to increasing liability to death or injury. A cow of the dairy breeds at the close of the period of usefulness is worth but a small sum, which depends upon her value on the block. Some breeds may be quite worthless and have a value only slightly greater than that of the hide; others will sell for good prices on the hoof.

The item of depreciation and its rate is worthy of consideration when deciding upon the breed of cattle to carry on the farm. An individual farmer, because of superior ability or selling methods, may be able to dispose of his depreciated cows from time to time, so that, from a financial point of view, his herd suffers no depreciation other than that caused by death and accident. Dairy men as a whole, however, can not escape this charge and the sale of animals at a price which eliminates depreciation does not in any way affect

¹ Items of insurance and taxes charged in general expense, hence not embodied in this estimate.

the dairy industry viewed in its entirety. From a business viewpoint, the fund ultimately to be used to replace an animal in the herd should be started at the time it is taken into the herd.

The total amount required for replacement must be that which at the end of the cow's period of usefulness will, in addition to the price realized for her, replace her with an animal of equal value. Thus the rapidity of depreciation depends upon the average productive life of the cow and the total amount of depreciation, in money values, upon the original value of the cow.

It has been impossible to calculate accurately the productive life of a cow. On the average farm a cow good enough to be retained in the dairy has a probable productive life of seven and one-half to eight years. Statements have often been made that the average productive life of a cow is six years. This period appears shorter than that indicated by the data accumulated. It is possible that in the herd of a special dairyman, where cows are highly fed and pushed to their capacity, six years may be their average productive life. But, under average farm conditions where the cows are not fed so liberally, nor on such concentrated foods, and where they have a normal amount of exercise, the profitable productive period is lengthened.

Based upon money values, the charge for depreciation increases rapidly as the value of the animal increases. The ordinary cow valued for dairy purposes at \$25 to \$30 can easily be sold for the block at full value. The special dairy cow valued at from \$30 upward must be sold at a loss when her period of usefulness has ended. Data accumulated in this investigation show that \$25 per head has been about the average price received from the butcher for special dairy cows, and has been used as a base in calculating depreciation. Aside from the loss in value of the individual, due to old age, the possibility of loss through death must be taken into consideration. This might well be considered as an item of insurance, but in this bulletin has been considered depreciation, since natural death plays a large part in the depreciation charges.

It has been found that in the total number of cows kept during the period investigated 13 natural deaths occurred, or that the liability of natural deaths in these herds was 1.2 per cent annually. This rate was more than doubled in the herds of pure-bred or highly-graded cattle and was less in the scrub herds. However, it was considered best in presenting the average conditions to base the rate upon the average for all herds rather than by special classes.

Depreciation then is made up of:

(1) The difference between the original value as a dairy cow and the value for the block at the close of the period of productivity,

whether due to decrease in production or to accident permanently injuring them as milk producers.

(2) Probability of death while still in the herd: Cows having an average value of \$35 and less are charged with a rate of depreciation sufficient to make up the annual loss by death in the herd of 1.2 per cent annually. Cows having a value of \$35 and over are charged at a similar rate for probable death and an additional charge for difference in the value between dairy cow and the animal when sold on the block.

The annual depreciation charge for such cows as are on the Northfield route having values above \$40 per head may be expressed by the following: Expectation of death*(1.2 per cent on cost), plus one-eighth the original value less \$25 (8 years being the average) equals the total annual depreciation. Expressed as an equation, annual depreciation=(1.2 per cent of value)+[12½ per cent of (value—\$25)].

HERD BULLS.

The charge to the herd for herd bulls is based upon the annual cost of maintenance of the bulls actually in use, and does not include young bulls kept upon the farm as an investment or for sale. The cost of maintenance is prorated on the same basis as that of cows, giving the annual charge per cow.

INTEREST ON INVESTMENT.

Interest on investment is charged at the rate current in the localities—at Northfield and Marshall 5 per cent and at Halstad 6 per cent. From a business point of view, interest upon the capital invested is one of the first charges to be met, whether the money used for this purpose is borrowed or is part of the owner's capital.

THE COST OF MILK OR BUTTER-FAT PRODUCTION.

In a statistical study of cost of production many features of interest to the producer, consumer, economist, and farm manager are investigated. Each feature reveals different aspects of cost and aids in explaining the final data expressed as dollars and cents or in making application of the knowledge acquired to the management of the farm. Therefore, cost of production has not only been determined in this investigation in terms of dollars and cents, but also in terms of quantities of foodstuffs and of labor. The final unit upon which cost is determined is the unit of product, but the present discussion is principally concerned with the primary unit—the cow—for it is through the average production of a cow and the cost of her maintenance that the final unit of cost of production is ascertained.

It should be remembered that all costs based on the average cow are obtained from data covering each route by years as detailed in the Appendix, Part III.

The quantity of food consumed, labor requirement, product, and all other items from other sections can readily be substituted in the tables shown here as an aid in determining individual or sectional costs.

FOOD CONSUMPTION PER COW.

Under farm conditions, with stock of mixed type, milk production is seldom proportionate to food consumption. The general practice of farmers is to make the greatest possible use of roughage and to reduce feeding of grain to a minimum, especially those grains which are of ready sale. The quantity of grain fed tends to vary somewhat with its price and availability, but there is a decided tendency to use farm grain rather than purchased concentrated mill feeds; this may or may not be good farm economy. However, if the grains fed are largely those containing high percentages of carbohydrates and fat, and are fed with wild or timothy hay rather than clover, the purchase of concentrated mill feeds becomes imperative. It is also probable that dairies located near grain-market centers will find it profitable to purchase mill feeds and sell grain, as a gain may be made through the exchange. This is the tendency on the Northfield route, where mill feeds constitute 38 per cent of the total grain fed. In making an exchange of this nature not only the relative selling price and cost price should be taken into consideration, but also the expense of making the transfer—that is, of marketing one product and of bringing to the farm the product purchased. On the farm located 5 miles from market this exchange would cost approximately 70 cents per ton each way, or if a load of coarse grains be hauled to market and a load of mill feed returned to the farm, a cost of \$1.40 would be incurred, which would properly represent a part of the cost of the newly purchased feed.

Theoretically, at least, the greatest error in feeding the farm cow is lack of liberality. A comparatively small proportion of cows may receive at times a ration sufficient for maximum milk production, but the greater number are constantly underfed. During June, July, August, and September little or no roughage or concentrates are fed. (See Appendix, Part III.) This leaves a period of 243 days during which partial or full feeding has to be resorted to. With an average pasture season for the State of 163 days, there remain 202 days during which a full ration must be provided.

TABLE VI.—Average annual food consumption per cow.

Year.	Northfield.				Marshall.				Halstad.			
	Rough- age.	Farm grain.	Mill feed.	Pas- ture.	Rough- age.	Farm grain.	Mill feed.	Pas- ture.	Rough- age.	Farm grain.	Mill feed.	Pas- ture.
	<i>Lbs.</i> (1)	<i>Lbs.</i> (1)	<i>Lbs.</i> (1)	<i>Days.</i> (1)	<i>Lbs.</i> (1)	<i>Lbs.</i> (1)	<i>Lbs.</i> (1)	<i>Days.</i> (1)	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Days.</i>
1904.....	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	5,290	635	15	168
1905.....	6,014	584	306	174	(1)	(1)	(1)	(1)	5,923	570	4	153
1906.....	5,272	418	308	173	3,409	1,045	33	178	6,005	906	55	124
1907.....	4,766	609	239	157	4,513	1,100	161	154	4,666	678	128	151
1908.....	5,554	421	420	170	3,939	631	250	182	6,501	706	59	162
1909.....	6,345	656	357	160	4,250	379	391	171	4,800	834	15	157
Average:												
1904-1909.....									5,531	722	46	153
1905-1909.....	5,500	588	326	167								
1906-1909.....					4,028	789	209	171				

¹ No data.

The average food consumption by routes shows differences in the quantities of grain and mill feed and roughage fed. This is due to the length of pasture season, quality, and kind of foods fed to different types of cow and to the difference in the ideals which prevail in the different sections. Northfield shows a higher quantity of roughage fed, due to the greater use of silage, than Marshall. The record of quantity of roughage fed at Marshall is low because of the use of straw for which no charge is made or account kept. The substitution of straw which has a low feeding value for the better kinds of roughage resulted in the consumption of an increased quantity of grain. The result of the method of feeding and of types of cattle used in terms of quantity of food required to produce a given quantity of milk is interesting.

TABLE VII.—Total food consumption per 100 pounds of milk produced.

Food.	Northfield, 1905-1909.	Marshall, 1906-1909.	Halstad, 1904-1909.
Roughage.....pounds..	106.4	98.0	133.9
Grain and mill feed.....do....	16.4	24.2	18.6
Pasture.....days..	3.1	4.1	3.6

Table VII is merely indicative of the food requirements as determined on the farm. While not on a scientific feeding basis, in that the animal is maintained at a maximum production without consideration of loss or gain in weight, the quality fed is the actual average of farm conditions on a number of farms for a series of years. As previously stated, observation of these farms tends to show that the chief fault with feeding is lack of liberality in the use of grain and mill feed. In many instances more liberal and continuous feeding would have resulted in a decided increase in production.

HOURS OF MAN AND HORSE LABOR REQUIRED IN CARE OF COW.

The time required for the care of the cow includes the time actually spent in going after cattle, milking, etc., marketing and care of the product, chores, and numerous other items that can not be designated as chores, but which consume time in the dairy enterprise. Roughly, the time expended in the care of dairy cows may be divided into milking, chores or care of cow, and marketing and care of product which includes separation of milk.

Milking requires from 45 to 60 per cent of the total time; chores, 20 to 25 per cent, marketing and care of the product the remainder. The percentages are affected by the nature of the business carried on and the extent of cooperation with neighbors. Where whole milk is hauled to the creamery or railway station each day, more time is required in that operation than where a separator is used and cream hauled three or four times a week. A difference more marked is where neighbors cooperate in marketing either milk or cream. The small quantity of cream obtained makes a larger circle of cooperation possible than where the whole milk is marketed.

TABLE VIII.—*Hours of man and horse labor required annually in care of cow.*

Year.	Man labor.			Horse labor.		
	Northfield.	Marshall.	Halstad.	Northfield.	Marshall.	Halstad.
	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>
1904.....	(1)	(1)	124.8	(1)	(1)	18.4
1905.....	134.7	(1)	126.2	41.1	(1)	18.2
1906.....	136.7	103.9	140.8	38.7	19.0	21.1
1907.....	130.4	111.9	147.4	27.5	17.1	21.2
1908.....	136.2	80.0	136.0	32.8	14.9	12.7
1909.....	125.5	73.7	148.3	35.6	38.7	12.9

¹ No data.

The greater number of hours of horse labor required where whole milk is marketed, rather than cream, is shown by the difference between the figures for Northfield and those for Halstad. At Halstad no whole milk is marketed, at Northfield very little cream.

The small amount of man labor required in the care of a cow at the Marshall route in 1908 and 1909 was due to the nearness of the farms to town and to the fact that during a greater part of the year most of the product was gathered directly by the purchaser.

The data (Table VIII) are based upon the average annual number of cows kept and include all labor performed, whether by men, women, or children, or horses, excepting that butter made in the home has been considered household work and is not charged against the dairy enterprise. This, however, has occurred very seldom. Labor of women and children has been converted in all cases into an equivalent of man labor.

PRODUCT PER COW.

The quantity of milk or butter fat produced per cow affects to a large extent the cost of production per unit of product. Cost of maintenance is approximately the same for a cow producing 5,000 as for one producing 6,000 pounds of milk annually. The only difference is the slightly greater quantity of food required to produce the additional 1,000 pounds of milk. Therefore, it is economy to produce milk from herds with high yields. Other conditions being the same, a cow with an average yield of 7,000 pounds per year will produce much more cheaply than one with a yield of 4,000 pounds per year, notwithstanding that the latter will show a maintenance cost several dollars less than the former.

Table IX shows the average yearly production of milk and butter-fat per cow at the three stations. In connection with the following tables on cost of production per unit of product, the influence of higher yields of milk is apparent, especially at Halstad, where the rapid increase in production almost maintained cost of production at a level for six years in spite of largely increased cost of maintenance.

TABLE IX.—Average production of milk and butter fat per cow.

Year.	Northfield.			Marshall.			Halstad.		
	Milk.	Butter fat.	Percent- age of butter fat to milk.	Milk.	Butter fat.	Percent- age of butter fat to milk.	Milk.	Butter fat.	Percent- age of butter fat to milk.
	<i>Pounds.</i> (1)	<i>Pounds.</i> (1)	<i>Per cent.</i> (1)	<i>Pounds.</i> (1)	<i>Pounds.</i> (1)	<i>Per cent.</i> (1)	<i>Pounds.</i> (1)	<i>Pounds.</i> (1)	<i>Per cent.</i> (1)
1904.....	5,359	197.9	3.7	3,379	129.2	3.8	3,546	140.5	4.0
1905.....	4,818	177.4	3.7	3,623	144.9	4.0	3,887	151.5	3.9
1906.....	4,992	176.4	3.5	4,840	206.3	4.3	4,030	156.5	3.9
1907.....	5,659	201.2	3.6	4,609	169.2	3.7	3,899	155.5	4.0
1908.....	5,434	185.8	3.4				4,399	178.3	4.0
1909.....							5,029	194.3	3.9
Total.....	26,262	938.7	3.6	16,451	649.6	4.0	24,790	976.6	3.9
Average, all years	5,252	187.7	3.6	4,113	162.4	4.0	4,132	162.8	3.9

¹ No data.

COST OF MAINTENANCE OF A COW.

The annual cost of maintaining a cow comprises the following items: Cash sundries, cash feeds, farm feeds, labor (man and horse), general expense, shelter, depreciation, machinery and equipment, herd bulls and interest on investment; the classification is somewhat arbitrary, as in some instances an item of cost might be charged to one class or another with equal correctness. Cash sundries comprise those items for which cash was paid—ropes, halters, veterinary service, and medicine. Cash feeds are those purchased for cash, farm feeds those produced on the farm. Labor includes both man and horse labor at the current rate of wages for the month

and year, comprising all items of labor performed for and affecting the dairy. General expense comprises those items which are a charge to the entire farm, and is made up of cash and labor expenditures; the total for the farm is then apportioned to the productive enterprises of which the dairy is one.

Shelter is a fixed charge for the use of the building based on its cost, depreciation, repairs, and the number of animals sheltered. Depreciation is based upon the productive life, death rate, original value, and final value of the cow for consumption.

Machinery and equipment charges are due to the use, depreciation, repairs, and interest on the cost of the machinery and equipment of the dairy.

The charge for herd bulls is the cost of maintenance.

Interest on investment is interest at the rate of 5 or 6 per cent on the value of the cow at the beginning of the year. All items represent actual expenditures on the farms, excepting the charges of shelter and depreciation, which are based on averages of all the farms for the entire period.

Possibly a further charge should appear against the dairy cow during those years in which a loss is shown on the young stock produced. This charge, however, more properly belongs to a separate enterprise and is not considered a charge against the cows, since the owner has the option either of raising or of otherwise disposing of the calf.

Table X shows the annual cost of maintenance of a cow as determined upon the statistical routes. The various charges entering into the items of the cost of maintenance have been segregated on the basis previously stated, and have been reduced to the cost per cow from tables contained in the appendix, showing the financial statement for the dairy enterprise in total.

TABLE X.—*Annual cost of maintenance of a cow.*

Item.	Northfield.						Marshall.				
	1905	1906	1907	1908	1909	True average 1905-1909.	1906	1907	1908	1909	True average 1906-1909.
Cash sundries.....	\$0.78	\$0.55	\$0.74	\$1.03	\$0.71	\$0.75	\$0.38	\$0.17	\$0.46	\$0.18	\$0.28
Cash feed.....	2.89	2.31	3.04	5.37	5.18	3.65	.16	1.67	2.46	3.64	1.49
Farm feed.....	22.77	23.87	24.12	27.00	21.72	23.88	18.69	22.43	20.17	18.30	20.32
Labor.....	16.99	17.26	16.47	22.88	20.56	18.66	13.64	17.01	12.74	14.65	15.01
General expense.....	3.15	2.64	1.43	3.47	2.67	2.53	1.53	2.21	1.31	3.05	1.97
Shelter.....	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46	2.46
Depreciation.....	1.68	1.97	1.82	4.50	6.74	3.19	.36	.35	.34	.40	.36
Machinery and equipment.....	.28	.26	.61	.99	.90	.58	.23	.66	.98	1.97	.71
Herd bulls.....	1.65	1.84	2.13	2.12	2.26	1.98	1.42	2.93	1.61	1.69	2.08
Interest on investment.....	1.77	1.83	2.02	2.53	3.62	2.34	1.59	1.46	1.46	1.52	1.51
Total.....	54.42	54.39	54.84	72.35	66.82	60.02	40.46	51.35	43.99	47.86	46.19

TABLE X.—*Annual cost of maintenance of a cow*—Continued.

Item.	Halstad.						True average 1904-1909.
	1904	1905	1906	1907	1908	1909	
Cash sundries.....	\$0.13	\$0.15	\$0.49	\$0.65	\$0.39	\$0.34	\$0.39
Cash feed.....	.11	.23	.40	1.05	.70	.16	.48
Farm feed.....	16.97	15.74	17.73	18.15	23.06	24.51	19.60
Labor.....	16.09	15.60	17.73	18.65	19.04	20.83	18.20
General expense.....	2.42	2.36	2.72	1.69	2.76	4.48	2.75
Shelter.....	2.46	2.46	2.46	2.46	2.46	2.46	2.46
Depreciation.....	.30	.28	.31	.29	.29	.32	.30
Machinery and equipment.....	.31	1.46	.76	.96	.81	1.32	.92
Herd bulls.....	1.85	2.90	2.19	2.07	2.79	2.88	2.42
Interest on investment.....	1.57	1.41	1.55	1.46	1.46	1.61	1.51
Total.....	42.21	42.59	46.34	47.43	53.76	58.91	49.30

Increasing cost of maintenance per year from 1905 to 1909 is clearly shown on all routes—the result of advance in cost of food, labor, etc.

In sections near important markets and centers of population the cost of maintenance is enormously increased over that in Minnesota. With roughage averaging \$5 per ton or less and grain feeds less than 1 cent per pound, the farmers in the rural districts of the Central West have a decided advantage over those in localities where grains are $1\frac{1}{2}$ to 2 cents per pound and roughage \$15 to \$20 per ton. In the latter case a cow can not be maintained for less than \$75 to \$100 per year. From the figures in Table X it is safe to state that the average annual cost of maintaining a cow in Minnesota under good conditions approximates \$60. This cost can be kept at a minimum through care and economy in feeding and judgment in marketing and handling the product from the farm.

PROPORTION OF THE COST OF EACH ITEM OF OPERATING EXPENSE TO THE TOTAL COST OF OPERATION.

The amounts expended for each item of operating expense do not bear any relationship to the total expenditure except in a series of years. However, the proportion of expenditure for each item is of interest in showing what part of cost is required in the various steps of production and as a guide to these expenditures on the farm.

Certain tendencies exist in the dairy industry where cows of better breeding, carrying dairy heredity, are being introduced and better shelter and care provided. Under these conditions an increasing percentage of expenditure for shelter, depreciation, and interest on investment is natural. Prices remaining the same, the proportionate expenditures for labor and feeds would decrease. Thus, as herds become better bred and of more value a relative decrease in cost of care and of feed may be expected. This is especially true after

stock reaches a value of \$100 or more per head. At this value depreciation is a very important part of cost, interest increases, and, in all probability, shelter cost increases.

TABLE XI.—Percentage of items of cost of maintenance to total maintenance.

Item.	Northfield, average 5 years.	Marshall, average 4 years.	Halstad, average 6 years.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Cash sundries.....	1.2	0.6	0.8
Cash feed.....	6.1	3.2	1.0
Farm feed.....	39.7	44.0	39.9
Labor.....	31.1	32.5	37.1
General expense.....	4.2	4.3	5.6
Shelter.....	4.1	5.4	5.0
Depreciation.....	5.3	.8	.6
Machinery and equipment.....	1.0	1.5	1.9
Herd bulls, maintenance of.....	3.3	4.5	4.9
Interest on investment.....	4.0	3.2	3.2
	100.0	100.0	100.0

The expenditures for food, prices being on a stable basis, remain practically the same even with an increase of productivity of cows and consequently of value. This fact is illustrated by the figures in Table VII, showing the quantity of food required in the production of 100 pounds of milk. Well-bred herds with an average of 5,250 pounds of milk per cow per year (Table IX), as compared with herds producing 4,130 pounds per cow, required less roughage and less concentrates in the production of the milk. Deductively, at least, these figures show the value of breeding and the generalization may be made that with increasing productivity and values the relative percentage of expenditure for feeds, price remaining the same, decreases, while depreciation, shelter, and interest increases.

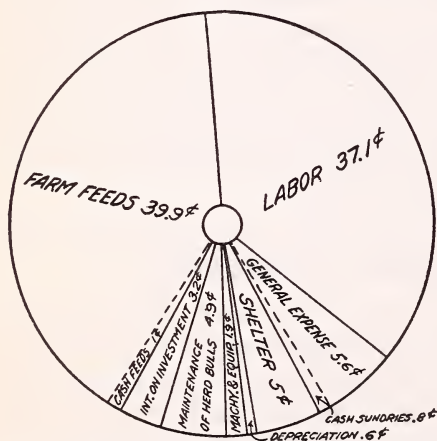


FIG. 2.—Itemized expenditure of each dollar for maintenance at Halstad.

Expenditures may be shown on a better basis by determining what part of each dollar used in operation is expended for the various items. This is shown by figures 2, 3, 4, and 5 for Northfield, Marshall, and Halstad.

The value of these graphics lies in their use as a guide by the working dairyman. As will be shown in subsequent pages, the cost of operation or of maintenance is constantly encroaching upon income and, if unproductive animals are kept in the herd, often sur-

passing it. The practical man then makes his profits either by reducing costs of operation or by increasing income. Theoretically, at least, the successful dairyman's expenditures on the different items of operation should only slightly exceed the percentages given above.

COST OF PRODUCTION OF WHOLE MILK AND BUTTER FAT.

The cost of producing whole milk and butter fat (Table XII) is based upon the total cost of operation (Appendix, Part III) and total product rather than upon the average per cow, as the former presents a broader basis upon which to work. Cost of production for each route is shown and the average, a mean of the cost on the three routes. The effort has been to give the cost on a commercial basis, the basis that exists when one is in the business to stay and has to pay for all items entering into cost. This record from year to year is especially valuable, not only as showing actual costs on combinations of farms, but also as a guide to the economic development of the dairy industry.

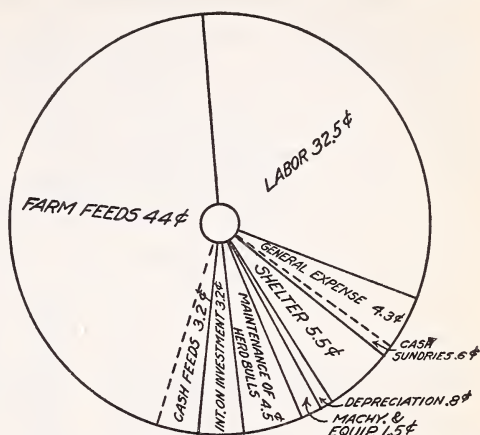


FIG. 3.—Itemized expenditure of each dollar for maintenance at Marshall.

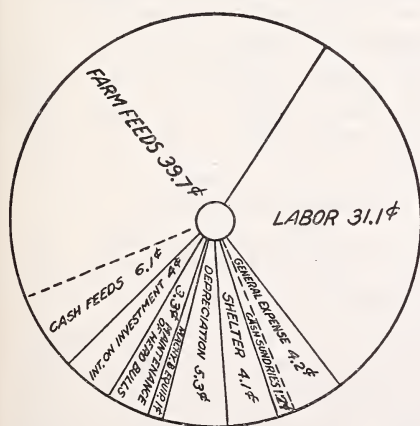


FIG. 4.—Itemized expenditure of each dollar for maintenance at Northfield.

utilization. The latter has been used as a basis in the computations in this bulletin. This method reduces the quantity of milk produced to the quantity of milk or butter fat actually used or sold. To illustrate, there is a slight mechanical loss in the various transfers of milk from pail to can, from can to cooling tank, etc.;

small quantities may be spilled, pails accidentally overturned, or numerous other losses may occur between cow and usable product. When the separator is used there is always a slight loss of butter fat because of careless skimming or the very small percentage of fat that can not be separated, besides the mechanical losses in handling. That is, the theoretical weight as determined by weighing the milk of each cow is slightly above the quantity that can actually be sold or used, due partly to errors in weighing or lack of exactness, but mostly to mechanical losses.

It has been impossible to obtain accurate comparisons on the farms between the product expected and that finally obtained. Investigations made at various times revealed a 3 to 10 per cent loss with an approximate mean of 6 per cent between butter fat expected and

that actually obtained for sale or use. The sale of milk was more economical, for the loss in that varied between 1 and 7 per cent, with an approximate mean of 3 per cent. This mean loss has been adopted as the basis upon which to compute the product possible for consumption, upon which the unit of cost is calculated. For example: A dairyman engaged in the whole-milk business finds his product by daily weighing to be 200 pounds. The mechanical loss on this quantity averages 3 per

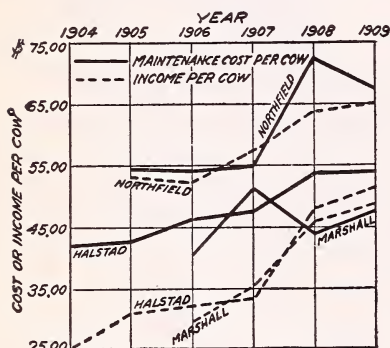


FIG. 5.—Relation of annual cost of maintenance and income per cow. All routes.

cent. Thus it is possible to sell only 194 pounds, and cost of production to the farmer should be based on this quantity. If butter fat is sold, the daily yield of milk and butter fat test may lead one to expect 40 pounds of butter fat from 1,000 pounds of milk. But, due to the mechanical and other losses, the product for sale or consumption is 6 per cent less, or 37.6 pounds.

It may be argued that these losses are, to a certain extent, avoidable, and that, therefore, cost should be based upon total product rather than usable product. Due consideration readily shows that from the viewpoint of cost of product cost must be based upon the product available for consumption which can be sold if desired.

Table XII gives the cost of production of milk and butter fat computed on this basis. The possible quantities of butter fat or milk, as expected from tests and weights, is shown in the Appendix.

TABLE XII.—*Cost of production of whole milk per hundredweight and of butter fat per pound.*

Years.	Northfield.					
	Average number cows.	Milk produced.	Butter fat produced.	Total cost.	Cost milk per hundredweight.	Cost butter fat per pound.
	(¹)	Pounds. (¹)	Pounds. (¹)	Dollars. (¹)	Cents. (¹)	Cents. (¹)
1904.....	124	643,187	23,798	6,740.82	104.8	28.3
1905.....	131	611,730	22,634	7,091.63	115.9	31.3
1906.....	116	560,756	19,626	6,347.68	113.2	32.3
1907.....	105	575,873	20,731	7,610.31	132.2	36.7
1909.....	103	546,431	18,579	6,934.48	126.9	37.3

Years.	Marshall.					
	Average number cows.	Milk produced.	Butter fat produced.	Total cost.	Cost milk per hundredweight.	Cost butter fat per pound.
	(¹)	Pounds. (¹)	Pounds. (¹)	Dollars. (¹)	Cents. (¹)	Cents. (¹)
1904.....	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
1905.....	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
1906.....	53	168,079	6,387	2,128.50	126.6	33.3
1907.....	61	206,300	8,252	3,109.66	¹ 150.7	² 37.7
1908.....	19	84,767	3,645	825.99	97.4	² 22.7
1909.....	19	81,216	3,005	902.78	111.2	² 30.0

Years.	Halstad.						Mean average of three routes.	
	Average number cows.	Milk produced.	Butter fat produced.	Total cost.	Cost milk per hundredweight.	Cost butter fat per pound.	Cost milk per hundredweight.	Cost butter fat per pound.
		Pounds.	Pounds.	Dollars.	Cents.	Cents.	Cents.	Cents.
1904.....	68	230,897	9,005	2,867.47	124.2	31.8	.....	.....
1905.....	53	194,615	7,590	2,276.44	116.9	30.0	³ 110.8	³ 29.2
1906.....	94	354,487	13,825	4,358.60	123.0	31.5	121.7	32.0
1907.....	93	339,750	13,590	4,414.62	129.9	32.5	131.3	34.1
1908.....	84	346,500	13,860	4,541.25	131.1	32.8	127.5	² 33.3
1909.....	82	384,513	14,996	4,846.90	126.5	32.3	124.9	² 34.3

¹ No data.² Weighted by four to make proper comparison in average of three routes.³ Two routes only.

NOTE.—Table 12 shows the cost of production of whole milk and butter fat on the basis of a main loss of 6 per cent between potential butter fat, as shown in the appendix, and salable product; likewise a loss of 3 per cent between milk production as shown in the appendix and product finally available for use or sale. The method used in determining quantities in this table depends upon the product sold. At Northfield the basis is whole milk; at Halstad and Marshall the basis is butter fat. The actual production of milk, as determined by weight, at Northfield in 1905, for example, was 663,079 pounds. The quantity of milk available for use, as on this route whole milk was sold, is this amount less 3 per cent, or 643,187 pounds, with a butter-fat content of 3.7 per cent (see Table IX), or 23,798 pounds. Cost is determined upon this basis. Where butter fat has been the basis of sales, as at Marshall and Halstad, the quantity of fat available for sale has been determined by subtracting 6 per cent of the fat produced from total production, and the available whole milk determined upon the basis of salable or available fat. At Halstad in 1904, for example, 9,580 pounds of fat were produced, leaving available for use 9,005 pounds. The fat contained in milk in 1904 was 3.9 per cent. The body of fat, 9,005 pounds, would thus have been actually 230,897 pounds of milk. The final average cost of production of butter fat or of milk for the three routes is based upon the mean average cost as determined from the three routes.

Comparisons of cost, its increase or decrease on the Northfield and Halstad routes, and on the Marshall route during 1906 and 1907, are especially valuable. In 1908 and 1909 at Marshall the number of farms on which dairying was carried on was reduced to two, both above the average in efficiency and production; the data is, there-

fore, not comparable with the years in which a larger number of farms were operated; cost of production was especially low in 1908, due to economies made in feed and labor.

The decrease in the cost of milk production per hundredweight on the Northfield route in 1909, as compared with 1908, without a corresponding decrease in the cost of butter-fat production, is due to the fact that the butter-fat content averaged 0.2 of 1 per cent less than in the previous year. The constant trend at Northfield, a milk-selling section, has been from a high per cent of fat to a lower. At Halstad, a butter-fat-selling section, there has been a constant increase in the fat content. Such opposite tendencies are natural in different dairy districts; the method of selling and the kind of product sold determine the ideal toward which the producer works—i. e., profit. Where whole milk is sold the most profitable herd is the one giving the largest quantity, irrespective of the butter-fat content. But where butter fat is sold the effort is to obtain the largest possible quantity of butter fat without particular regard to the quantity of milk produced. In the latter section a cow is valued by production of butter fat rather than by milk yield.

The cost of production per unit of product may be decreased by either of two methods: (a) By decreasing the cost of maintenance per cow, product remaining the same, which is not economically probable; (b) by increasing production per cow through better methods of care, feeding, and breeding, with slight additional cost.

The latter method is economically possible and is the basis upon which progressive and successful dairymen make their profits. It is exceedingly important that the producer bear in mind that, except where very high prices for his product prevail, the cow giving average yields must invariably be kept at a money loss. Although in many cases the farmer may be warranted in retaining such cows for a short time, good business management demands at least sufficient improvement in yields to make the income from the product equal to the cost of maintenance.

COST OF PRODUCT COMPARED WITH PRICE RECEIVED.

In an investigation of this nature the question of price received for the product is of importance as well as the cost of production. Dairymen have been more interested in the prices of their products than in the cost of production, apparently forgetful of the fact that profits accrue to the business dairyman as they do to the manufacturer in two ways: First, from a price for his product sufficient to more than cover the average cost of production; secondly, from cheapening the cost of production sufficiently to obtain a profit. The latter method offers the greater opportunity to the dairyman with a well-organized business, one who will study and apply economies to the industry.

In many localities, through cooperative creameries especially, dairymen have been enabled to obtain materially higher prices for their products. But even this advantage has not, in some instances, been sufficient to cover cost of production as revealed by an accurate investigation of the business. Comparisons of cost of production and price received are of the greatest value in the data relating to Northfield and Halstad, the number of farms at those stations remaining the same and the farmers having continued practically the same selling methods throughout the entire period.

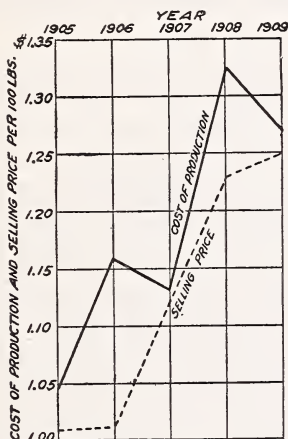


FIG. 6.—Average cost of producing milk per 100 pounds and price received, Northfield, 1905-1909.

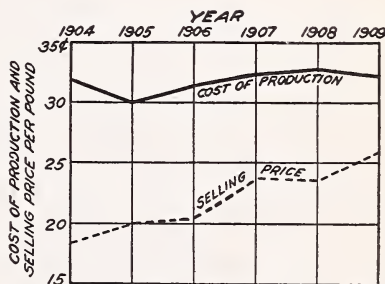


FIG. 7.—Average cost of producing butter fat per pound and price received, Halstad, 1904-1909.

Table XIII shows the average annual cost of production and the average price actually received for butter fat at Halstad, 1904-1909, and whole milk at Northfield, 1905-1909.

TABLE XIII.—Average annual cost of producing butter fat at Halstad and whole milk at Northfield, compared with average prices received.

Year.	Butter fat (Halstad).		Whole milk (Northfield).	
	Cost of production per pound.	Price received per pound.	Cost of production per 100 pounds.	Price received per 100 pounds.
	Cents.	Cents.	Cents.	Cents.
1904.....	31.8	18.4	(¹)	(¹)
1905.....	30.0	20.0	104.8	100.8
1906.....	31.5	20.5	115.9	101.2
1907.....	32.5	23.7	113.2	112.3
1908.....	32.8	23.6	132.1	123.0
1909.....	32.3	26.1	126.9	125.0

¹ No data.

NOTE.—A gallon of milk, based upon the wine gallon (231 cu. in.) at a specific gravity of 1.032, weighs 8.59 pounds or 11.6 gallons weigh 100 pounds. In many cases, while the sale of milk is nominally based upon the hundredweight, the 5, 8, or 10 gallon can is accepted as the common measure or criterion of weight, and no weighing is actually done. The average cost or price per gallon may be ascertained by dividing price per hundredweight or cost by 11.6.

The selling price is the average annual price of the product actually produced and sold, rather than a mean of the weekly or monthly prices. The latter prices would be correct only if the quantity sold were the same each month of the year.

As prices of milk are subject to somewhat violent fluctuations, being lowest in the summer months, the true average price can be ascertained only by dividing total money received by total product sold.

TOTAL ANNUAL INCOME OR EARNINGS PER COW FROM ALL SOURCES.

Of equal interest with the cost of maintenance of a cow and the cost of producing the product is the income from a cow. Two kinds of income, direct or indirect, are obtained from the cow or from any other class of live stock. Direct income is the cash actually earned and is the important item in determining the profitableness of the cow. Cash income, or its equivalent, is obtained almost wholly from three sources: (1) from the actual sale of milk or its products; (2) from the value of the products (milk, skim milk, cream, butter fat, etc.) used in the house; (3) from the value of the products (skim milk, buttermilk, or whole milk) fed on the farm to swine, calves, poultry, or colts. Indirect income is obtained from the calf and the manure. In some localities these products may have a cash or exchange value. In many, however, notably in many Western States, the only value which may be assigned to them is theoretical and can not be embodied in ledger accounts as part of the income from the cow.

Under average farm conditions, such as prevailed at Marshall and Halstad and part of the time at Northfield, the cost of keeping the young stock on the farm was greater than the income obtained from their sale. No value has been assigned to the newborn calf of ordinary farm stock, because it is raised or kept at a loss. Calves from high-grade or pure-bred dairy cows, bred to pure-bred dairy bulls, however, may be sold at prices much above the cost of rearing. The latter condition prevailed at Northfield during late years of the investigation. The profits from young stock varied from \$300 to \$900 annually, or, approximately, from \$3 to \$9 per cow; the average profit for five years, including years of loss, would be approximately 62 cents per cow. As average conditions are presented, this credit, a part of which should, of course, belong to the other cattle enterprise, has not been included.

The second source of indirect income from the cow is the manure. This valuable by-product of the farm has in many localities a cash value. Upon western farms, however, where no mineral

fertilizers are purchased, no cash value is assigned to this by-product. It is customary to estimate the manurial product of the cow as worth the labor of her care, or the manure and calf as of that value. The question of the value of manure has not been fully established under farm conditions, although this investigation has shown that the calf from the ordinary cow kept under average farm conditions can not be considered a source of income to the dairy. The value of the manure, however, is more problematical. Its value as measured by increase in yields is in some cases high; in others low, depending upon (*a*) the crop grown immediately after manuring; (*b*) the heaviness of the application; (*c*) kind of soil and its comparative richness or poorness; (*d*) climatic conditions, price of products, etc.

By some authorities the value of manure is estimated on the basis of cost of mineral fertilizers containing the same amount of the fertilizing elements as the manure, although the result is generally admitted to be too high. By other authorities estimates of value are based upon expected increase in yield of crops from the manured land, and the value set at \$1.50 to \$3 per load, or per cow from \$10 to \$30 per year. All of these estimates indicate the manurial product to be of great value to the farm and that permanent systems of agriculture are impossible without live stock. This investigation has been carried on in districts in which any value assigned to the manure would have been purely theoretical; hence, while the value and importance to the farm of this by-product is fully recognized and given proper consideration in all farm problems, it has not been thought desirable to include its theoretical value in the financial accounts.

The term "from sales" (Table XIV) indicates the actual cash received for milk products and (other than cash from the sale of cows) is the only cash income from the dairy. The products used in the house or fed on the farm have been charged at the market price; hence, are on the same basis as cash, though no exchange of product or money has actually taken place. A price of 15 cents per hundredweight has been adopted in all years for all skim milk used. At present prices of feed grains the value assigned to skim milk may seem low. However, a close study of conditions which prevail in the feeding of these products on the farm indicates that the value assigned is higher than that obtained by the farmer under average conditions.

TABLE XIV.—Average annual income per cow from milk products.¹

Year.	Northfield.				Marshall.				Halstad.			
	From sales.	From use.			From sales.	From use.			From sales.	From use.		
		In house.	On farm.	Total.		In house.	On farm.	Total.		In house.	On farm.	Total.
1904.....	(²)	(²)	(²)	.....	(²)	(²)	(²)	.....	\$12.12	\$9.19	\$4.26	\$25.57
1905.....	\$49.85	\$1.73	\$1.46	\$53.04	(²)	(²)	(²)	.....	13.13	13.75	4.30	31.18
1906.....	49.15	1.48	1.64	52.27	\$13.73	\$11.49	\$4.45	\$29.67	20.79	6.85	4.66	32.30
1907.....	53.71	2.52	1.21	57.44	18.20	13.10	4.17	35.47	22.26	7.23	3.77	33.26
1908.....	60.74	1.11	1.98	63.83	30.98	8.39	7.35	46.72	36.20	9.12	2.80	48.12
1909.....	58.52	2.38	4.25	65.15	37.68	4.74	6.51	48.93	34.91	12.27	4.15	51.33

¹ Based on average number of cows kept through year.² No data.

RELATION OF COST OF MAINTENANCE AND INCOME.

An immediate and pressing question to the dairyman or the farmer is the relation that income bears to cost of operation. Figure 5 (p. 34) shows graphically the annual cost of maintenance and the annual income for all stations.

Income exceeded maintenance cost at Northfield in 1907, due to the close relationship of cost of product and price received, but in 1908 and 1909 income again dropped below the cost of maintenance. At Marshall the decrease in cost of maintenance and increase in income produced a profit during 1908 and 1909, but with cost rising more rapidly than income during 1909.

The rise in income has been almost directly proportional to the rise in prices, while the increases or decreases in maintenance have been very closely related to increased or decreased prices for feeds and labor.

A feature worthy of note is the small proportion of these products used on the farm at Northfield, a district engaged in the sale of whole milk, and the great farm use of them at Marshall and Halstad, the creamery districts. At the last-named station the use of dairy products from the farm plays a large part in the family dietary. At Northfield, comparatively small quantities are used in the house. Incidentally, the great use of dairy products, particularly skim milk, at Halstad, is reflected in the cost of board, and has helped to cheapen this cost.

The almost constant increase in the income from year to year may be ascribed to two causes: First, advance in prices of dairy products; second, increased production of milk or butter fat per cow. Increased production has had more effect upon income at Halstad and Marshall than increase in price; at Northfield, income has been affected to a greater extent by increase in prices.

The average income per cow at the three stations in 1909 had reached a point considerably above the average for the State, but was still less than the cost of maintenance. Under average conditions, such as prevailed from 1905 to 1909, an income of approximately \$60 per cow must be obtained in order to carry on the dairy industry at a profit. In locations not especially favored with low-priced feeds and relatively high-priced products the total income has to average \$75 per annum to assure a profit.

THE SEASON OF MILK PRODUCTION.

The time of year during which the major part of the milk is produced may materially affect cost of production as well as income from the dairy. Milk can be produced much more economically during the pasture months than during the winter when stall feeding is necessary. There are other items than feed, however, to be taken into consideration. Labor conditions in summer often make it difficult to properly care for the stock; during the winter stock, even though dry, must be fed and cared for; a small amount of feed and care additional to that required for maintenance may prove profitable; and, lastly, prices for dairy products are so much higher in winter than in summer that the total income per cow is larger and net profits more satisfactory, provided the large flow of milk be produced during the winter months.

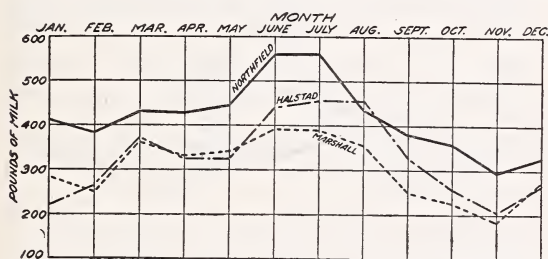


FIG. 9.—Average yield of milk per cow, by months, Northfield, Halstad, and Marshall, 1907.

Labor conditions in summer often make it difficult to properly care for the stock; during the winter stock, even though dry, must be fed and cared for; a small amount of feed and care additional to that required for maintenance may prove profitable; and, lastly, prices for dairy products are so much higher in winter than in summer that the total income per cow is larger and net profits more satisfactory, provided the large flow of milk be produced during the winter months.

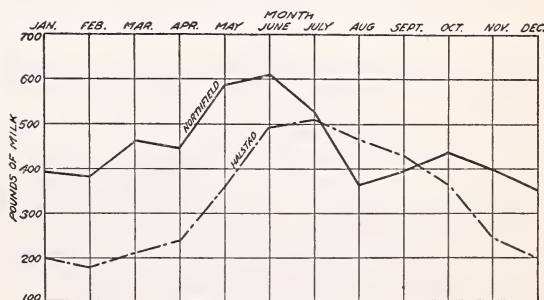


FIG. 10.—Average yield of milk per cow, by months, Northfield and Halstad, 1905.

Figures 8, 9, 10, 11, 12, and 13 show graphically the fluctuation from month to month in milk production, and the tendency from year to

year to straighten the line of production, eliminating violent fluctuations. The average monthly yield per cow has been a little higher in the first and last months of each year. This is especially noticeable

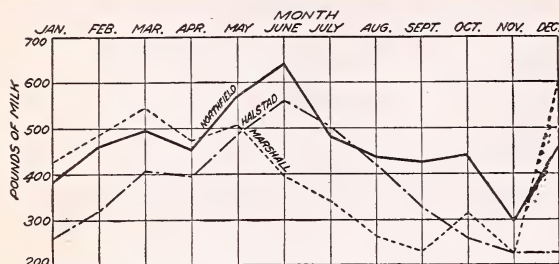


FIG. 11.—Average yield of milk per cow, by months, Northfield, Marshall, and Halstad, 1908.

at Halstad, where, during the winter or feeding months in 1904, the yield per cow was about 1,000 pounds, by 1909 this herd had increased to over 2,100 pounds during the same months.

Other advantages

of winter dairying might be cited, but the strongest argument in its favor is its adoption by the most capable dairymen and the constant tendency in the dairy sections toward maximum production during the winter months.

On all routes, commencing May, June, or July, very marked and rapid declines in the yield of milk are shown. These continue until October or November,

when increases are shown. This can be ascribed to two causes: An actual diminution of the milk supply during the intervening months, due to poor grass, feed, and flies, and the drying up of cows preparatory to the winter production of milk. In this connection the slight declines in the spring months should be noted; the

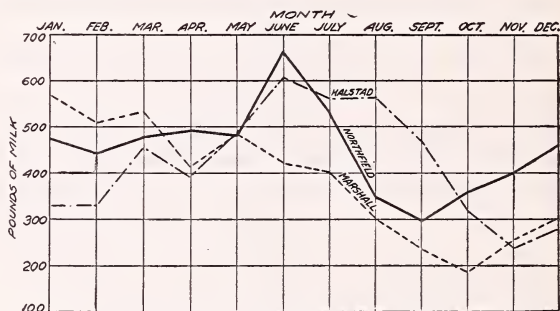


FIG. 12.—Average yield of milk per cow, by months, Northfield, Marshall, and Halstad, 1909.

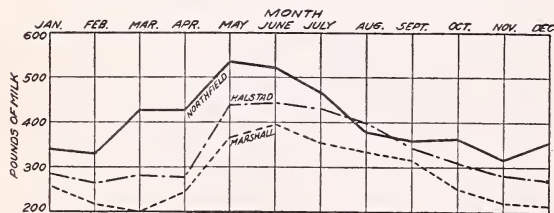


FIG. 13.—Average yield of milk per cow, by months, Northfield, Halstad, and Marshall, 1906.

effect of the pasture season has been to maintain and increase the yield of the cows already in milk, while the cows that freshen at this time of the year are kept at a maximum of production during the first flush of grass.

APPLICATION OF COST STATISTICS TO METHODS OF MANAGEMENT.

An accurate knowledge of cost of production and of maintenance and of the results of methods of management expressed in comparable terms are prerequisite to successful management of either the dairy or farm. The transition of agriculture to a skilled occupation and a profession placed it upon a basis where guesswork as to costs of operation or as to the relation of costs and income can no longer be tolerated by capable farmers. An exact knowledge of the various items of cost, of the effect and value of capital investment as related to productivity was required, that it might be applied to the individual farm problems. Business farmers realize, as manufacturers realize, that precluding an increase in price of product, the best returns are obtained through economies either in making capital or labor more productive. The study of facts which show results accurately is the basis for the test of efficiency of management. Hence, brief illustrations are given of the application to individual farm conditions of statistics of cost. Many, in fact most, farm problems will have light thrown on them by the applications of the data to the conditions which may prevail in that section.

EFFECT OF INCREASED PRODUCTION ON COST PER UNIT OF PRODUCT.

Experimental data show the marked economy of productive or high yielding cows. This economy, however, is difficult to show in farm practice. While economy of production is universally admitted among the best business dairymen, there has ever been a question among the rank and file as to either possibility of obtaining high average yields per cow or the profit from the cows of large productive capacity.

Fortunately, the investigation at Halstad has been carried through a period of continuous increase in the average yield per cow. Calculating the cost of food consumption upon a basis of uniform values for all years and the cost of other items of maintenance at actual values, the value of high yields and the cost of increment of product can be approximately determined. The figures, though not scientifically correct, will elucidate the facts well from the viewpoint of actual farm conditions. It should be noted, however, that climatic conditions, quality of feed, care of stock, etc., may have a great effect upon the result.

In order that data may be as nearly comparable as possible, only the months in which the herds were on full feed are considered—the months in which there is no pasturage, November, December, January, February, March, April, and in some years May. The

total food consumption per hundred pounds of milk has been placed upon a uniform money basis for all years, roughage at one-fifth cent per pound, and grain and mill feed at 1 cent per pound. The investigation has been divided into two periods of three years each to reduce the effect of the annual variations which may occur, and which may be due to climatic or other conditions. In the first period the average yield of milk per cow in months of full feed was 1,213 pounds and in the second 2,107 pounds, giving an average net increase of 894 pounds. Incidentally, taking the entire year into consideration, including all months, the increase was 621 pounds, indicating that the deductions from data relative to the months on full feed can properly be applied to the entire year.

To show the effect of increasing yield on cost, labor, interest, etc., the cost of all other items of maintenance than feeds for 1904 has been taken as a base number on which to determine the costs other than feeds for an increased milk production. For example, the cost of maintenance other than feeds in 1904 (Table X) was \$24.98, the cost in 1906 was \$28.23, or \$3.25 over 1904. This is practically the extra cost required to produce 4,030 pounds (Table IX) instead of 3,546 pounds of milk. On account of difference in cost of labor and the advancing prices from year to year of the material used in the dairy, differences obtained in this way are not all due to the increased milk production. Whatever the error may be, it is against the years of high production and favors those of low production.

Each year has been compiled on a basis of food cost and items other than food cost, 1904 being taken as 0 and averaged into three-year periods.

TABLE XV.—*The effect of increased production of milk in diminishing the cost of its production.*

Year.	Average milk yield per cow for months on full feed.	Cost of food per hundred-weight of milk.	Cost of items other than food per hundred-weight of milk above base number of \$24.98.	Total cost of milk per hundred-weight.	Diminished cost due to higher yields.
	Pounds.	Cents.	Cents.	Cents.	Cents.
1904, 1905, 1906.....	1,213	112	6 $\frac{2}{3}$	118 $\frac{2}{3}$	.....
1907, 1908, 1909.....	2,107	77	13 $\frac{3}{4}$	90 $\frac{3}{4}$	28

The rise in prices of other materials than feeds during the six years was between 15 and 21 per cent. Thus the actual decrease in cost during the period should be about 30 cents per hundredweight rather than 28 cents. However, this serves to illustrate the marked advantage to the producer of having a productive herd. The increase in production during the time was due to better care and

feeding and better breeding. All have exerted some influence on cost, an influence, however, that is not determinable with herds on the farm. It is possible, however, on any farm to show by actual costs the value of a high production per cow. Increasing the efficiency of the herds is not only feasible, but one of the best methods of economizing. All data obtained show clearly that at average prices cows must produce not less than 5,000 pounds of milk or 200 pounds of butter fat per annum to pay for the cost of maintenance. A yield above 5,000 pounds commences to pay a profit, except in localities where feed and labor costs are higher than the average.

It is a safe generalization that under ordinary farm conditions in Minnesota, or generally through the Northwest, every 100 pounds of milk over 5,000 pounds per annum, or pound of butter fat over 200 pounds per annum, largely represents net profit. Close observation and study of dairy herds on these farms for several years fully convince the author that it is quite possible for the farmer to turn the ordinary dairy herd, operating at a loss, into a profitable enterprise in from two to four years. It can be done most rapidly by utilizing the principle of diminishing cost per unit, which only requires efficiency in the herd.

COST OF PRODUCTION AND ITS RELATION TO PROFITABLE YIELDS.

The cost of feed and labor, the cost of the cow, and all other items of cost of maintenance determine the quantity of the product a cow should yield in order to give a profit.

As the cost of feed, labor, and the capital investment per cow increases or decreases, in such proportion must the efficiency of the herd increase, price of product remaining the same, to give a profit to the owner.

In order that a cow may be profitable, cows and capital invested should bear a certain and definite relationship to the product that must be obtained. The question frequently arises, What is a cow worth that gives a certain quantity of milk, and how much milk must a cow of a certain value give before she makes a profit? This question can be answered definitely, providing the cost of feeding, care, etc., is known, and the average price received for the product can be ascertained. It can only be answered exactly from a productive viewpoint. If the by-products, manure and calf, are assigned values, the relative production required to cover maintenance cost is lessened, and premises other than those given must be assumed. Table XVI shows the cost of keeping cows of different values and the quantity of milk they must produce at \$1.20 per hundredweight, equivalent to 27 cents for butter fat in 4 per cent milk, to repay the cost of maintenance. The average results at Northfield have been

taken as a basis for cost of all items other than interest and depreciation. These items, it is assumed, remain the same in the several cases. The only change that occurs is in the value of the cows, this affecting interest and depreciation charges.

The interest of this table relates particularly to these localities, where, for various reasons, cows, often of mediocre breeding and efficiency, have to be purchased at high values. It is imperative that cows of high values, to be profitable, should be more productive than the average. From a productive viewpoint a farmer can not afford to pay \$80 or \$100 for a cow unless she will produce 5,500 to 5,900 pounds of milk. The value of the cow as a producer of calves and of manure should also enter into consideration, but the farmer who derives his income from the sale of milk or butter fat, as do most dairymen, can only determine values as based upon productivity.

TABLE XVI.—*Annual cost of maintenance of cows of different values and quantity of milk at \$1.20 per 100 pounds required to cover cost of maintenance.*

Value of cow.	Cost of maintenance per year.			Milk at \$1.20 per 100 pounds required to cover cost per year.
	Interest and depreciation.	All other costs.	Total.	
<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Pounds.</i>
40.00	4.36	54.45	58.81	4,901
50.00	6.22	54.45	60.67	5,056
60.00	8.10	54.45	62.55	5,212
70.00	9.96	54.45	64.41	5,368
80.00	11.84	54.45	66.29	5,524
90.00	13.70	54.45	68.15	5,679
100.00	15.58	54.45	70.03	5,836
110.00	17.44	54.45	71.89	5,991
120.00	19.32	54.45	73.77	6,148
130.00	21.18	54.45	75.63	6,302
140.00	23.06	54.45	77.51	6,459
150.00	24.92	54.45	79.37	6,614

A difficult task of farm managers is to keep all capital employed in such a way as to produce maximum profits. The investment of money in live stock which do not bring a return commensurate with the cost of maintenance and capital invested is a common source of loss. It is easy to pick out a herd of cows at \$70 or over per head that will not give an adequate return for the cost. That stock is often purchased at values far exceeding that warranted by the value of their product has frequently been revealed during this investigation. The principal cause is that prices have been paid for live stock on the basis of gross income without regard to maintenance cost.

The same economic forces apply to the investment of capital in cows as to its investment in lands—that is, as either increase in value or are purchased at high prices, they must, to be profitable, become more productive because of gross increase in interest and depreciation charges.

Both interest and depreciation are very high when cows are purchased at \$100 per head or over. The annual charges are then \$15.58 or more per year, as compared to \$4.36 for the \$40 cow.

The value of a cow that produces a certain quantity of product can be determined as closely as possible by ascertaining the cost of production and capitalizing the difference between that cost and the total receipts from the products. In order to indicate the approximate value of a cow from a productive viewpoint, the cost of feeds and of items other than feeds at Northfield has been taken as a basis. Cost of labor has been increased according to the average increase per 100 pounds of milk as determined in Table XV, while feeds have been increased on the basis of the standard nutriment requirements to produce 1,000 pounds of milk. Thus the cost of maintenance increases with each successive 1,000 pounds of milk produced. Average prices for foodstuffs and labor which prevailed at Northfield are used.

TABLE XVII.—*Value of cows of high and low yields with milk at \$1.20 per 100 pounds.*

Yield of milk.	Income from milk at \$1.20 per 100 pounds.	Cost of maintenance other than depreciation and interest.			Value of cow.
		Feed.	Items other than feed.	Total.	
<i>Pounds.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>
4,000	48.00	28.15	25.65	53.80	¹ —116.00
5,000	60.00	31.51	26.95	58.46	25.00
6,000	72.00	34.31	28.25	62.56	67.00
7,000	84.00	37.41	29.55	66.96	108.00
8,000	96.00	40.11	30.85	70.96	150.00
9,000	108.00	43.67	32.15	75.82	189.00
10,000	120.00	45.25	33.45	78.70	230.00

¹ Loss \$5.80 capitalized equals minus value of \$116.

The average cow producing 4,000 pounds of milk annually would, under these circumstances, be kept at a loss of \$5.80 per annum, and would not only be valueless from a productive viewpoint, but would represent a liability to the farm, rather than an asset, unless the value of the manure and of the calf were considered sufficient to offset the loss occasioned by her use. Even including these values the use of an animal producing at a loss is doubtful economy; the effort should be to find a class of stock which would furnish manure without involving an annual loss of \$5.80 per head. With milk at \$1.20 per 100 pounds, or butter fat at 27 cents per pound, and with food and labor requirements at the prices determined, a cow has no value based on productivity until her annual product is between 4,500 and 5,000 pounds of milk. When 5,000 pounds of milk are produced annually a cow has a value of \$25. That is, the difference between the sum received for her product and the cost of obtaining it capi-

talized permits of a valuation of \$25 on which interest at 6 per cent must be earned and a sufficient sum set aside to cover depreciation. As the annual product increases over 5,000 pounds, the productive value of the cow increases very rapidly. When 6,000 pounds are produced annually, her value is more than two and a half times that of a cow producing 5,000 pounds annually. The cow giving 10,000 pounds of milk annually is worth \$230 as a producer. Obviously, a cow giving 10,000 pounds of milk annually has a higher value than that based upon her productive capacity, for her value as a breeder has to be considered. Her offspring having hereditary powers of high production have a much greater potential value than those from cows of low yield, and consequently are sold at remunerative prices.

Table XVII shows strikingly the effect of increased production and its relation to maintenance costs. The margin of profit of earnings between income and cost increases rapidly with increased production. After the cost of maintenance is paid by a product, each additional hundred pounds of milk yielded represents a tremendous advantage in earnings as the fixed charges are relatively decreased and the cost of production of each additional 100 pounds relatively low.

No better illustration can be made of the value of productive cows than the comparison between the cow giving 10,000 pounds and the one giving 4,000 pounds. The former represents a capital investment that is extremely productive, that pays for all she receives and gives an ample return and protection on her own value; the latter nets a loss of \$5.80 per year, or, in other words, if she were given to the farmer, he could not legitimately consider her as an asset so long as he was forced to keep her. During this time she would represent an actual liability to the farm of \$116 and would offset that amount of productive capital.

ECONOMIC POSITION OF THE DAIRY IN RELATION TO THE FARM.

An extended discussion of the cost of production of any one product obtained from one of the enterprises of the farm raises the query as to how the cost of this enterprise affects the profits on the farm or the income of the farmer. What relationship this single enterprise or the sale of this product bears to the gross cash income of the proprietor and what proportion of the cash income of the farm is obtained from this source? These questions are intimately connected with the cost of production and with profitable methods of farm management.

Very few farms in the State are devoted entirely to dairying or derive all of their income from dairy products. Even the specialized dairy farms carry on numerous other enterprises connected with

growing crops and handling other classes of live stock. Hence, their cash income is obtained from several sources other than the dairy—small quantities of grain, poultry products, or live stock are sold, all of which make up the gross income of the farms. The average farm in the so-called dairy States probably obtains 25 to 30 per cent of its gross cash income from the dairy.

Farms which obtain as high as 80 per cent of their cash income from the dairy may be considered as highly specialized dairy farms. On these farms practically all of the farm operations are conducted for the purpose of producing milk or butter fat. Many of them are very profitable, but require high-grade methods of management and superior business judgment. However, the bulk of milk products finally sold are not produced upon these highly specialized dairy farms, but on those where the dairy is only one of the productive enterprises, enabling the farmer to profitably dispose of roughage and coarse grains otherwise not readily salable. It is particularly important that on these farms the dairy be carried on at a profit not only because of the advantage to the proprietor, but to society as a whole.

TABLE XVIII.—*Average cash income per farm from dairy products and sales of cows and miscellaneous cattle.*

Year.	Northfield.				Marshall.				Halstad.			
	Cash from dairy.	Cash sales of cows.	Cash sales of miscellaneous stock.	Total cash sales.	Cash from dairy.	Cash sales of cows.	Cash sales of miscellaneous stock.	Total cash sales.	Cash from dairy.	Cash sales of cows.	Cash sales of miscellaneous stock.	Total cash sales.
	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.
1904..	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	103.35	22.65	64.96	190.96
1905..	770.24	180.28	76.25	1,026.77	(1)	(1)	(1)	(1)	88.02	31.97	79.04	199.03
1906..	802.83	242.79	88.88	1,134.50	120.33	70.45	412.26	603.04	279.16	52.50	132.44	464.10
1907..	885.53	113.66	161.63	1,160.82	183.73	72.96	59.44	316.13	295.58	90.19	105.54	491.31
1908..	911.95	413.31	414.86	1,740.12	296.70	68.10	1,069.64	1,434.44	290.45	72.09	115.78	478.32
1909..	861.09	597.55	408.92	1,867.56	364.77	.....	977.35	1,342.12	409.30	50.89	169.47	629.66

¹ No data.

² The total cash sales at Marshall, 1908 and 1909, are affected by the sales of cattle purchased and used for other than dairy purposes during these years.

An industry carried on at a reasonable profit is not subject to the violent variations in activity that occur in one alternately showing high profits or great losses. The freedom of the operation of the industry from speculative influences is one of the great economic advantages of the farm dairy, for in this industry little encouragement is given the farmer who expects to engage in it and reap exceptionally high rewards and then withdraw. The very nature of the enterprise makes it almost impossible to engage in it for only a short period and retire without serious losses. In fact, success is most frequent among those spending years in building up their herds to a

point of high productivity. It is a permanent rather than a temporary form of industry as applied to the farm. It has a restraining influence upon those engaging in it. This fact prevents to a large degree either enormous under or overproduction.

The dairy industry particularly aids the farmer, in that it affords a steady income from month to month and enables him to have a continuous market for his labor and farm products. It is of particular importance to the farm as a whole, in that it aids in keeping up the fertility of the soil, thus maintaining the production of the farm crops at the maximum.

The cash income arises from the sale of dairy products and the young stock which may be directly attributed to the dairy industry. The accompanying table shows the actual cash receipts from these three sources, the only sources of cash income to the farmer from the dairy. This represents actual cash income and does not include income other than cash shown in Table XIV.

This comparison is made by farms, and the three routes may properly be compared on this basis, although the years 1908-9 at Marshall have been affected by including the sale of miscellaneous cattle that can not properly be attributed to the dairy industry.

The percentage of sales from the dairy, compared to sales from the entire farm, shows the comparatively small part that dairying plays in farm economy in sections of the State in which the industry is poorly developed. The average total cash sales per farm show very decided increases, due not only to greater productivity but also to increased prices. At the same time the sales from cattle have increased more rapidly than total farm sales, due no doubt to increasing efficiency in the dairy herd.

TABLE XIX.—*Total cash sales per farm, total sales per farm from dairy cattle, and percentage to total sales.*

Year.	Northfield.			Marshall.			Halstad.		
	Total cash sales per farm.	Cash sales per farm from cattle.	Per cent sold from cattle to total sales.	Total cash sales per farm.	Cash sales per farm from cattle.	Per cent sold from cattle to total sales.	Total cash sales per farm.	Cash sales per farm from cattle.	Per cent sold from cattle to total sales.
	<i>Dollars.</i>	<i>Dollars.</i>	<i>Per cent.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Per cent.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Per cent.</i>
1904.....	(1)	(1)	(1)	(1)	(1)	(1)	2,114.01	190.96	9
1905.....	2,453.11	1,026.77	42	(1)	(1)	(1)	1,393.97	199.03	14
1906.....	2,750.46	1,134.50	41	3,767.76	603.04	16	1,645.49	464.10	28
1907.....	2,569.27	1,160.82	45	2,872.80	316.13	11	3,484.39	491.31	14
1908.....	3,043.29	1,740.12	57	3,710.89	1,434.44	2 39	4,042.45	478.32	12
1909.....	3,260.18	1,867.56	57	3,744.35	1,342.12	2 36	3,907.58	629.66	16

¹ No data.

² Includes sales of beef or of stockers. The sales per farm from dairy cattle are 9.8 per cent of total sales in 1908, and 9.7 per cent in 1909.

The comparison of gross income per farm on the Northfield and Halstad routes serves to present cogently the value of live stock on the farm and its relation to and effect on gross income. The average farm at Halstad, including the large farm, is 501 acres and the average at Northfield 169 acres, yet the average gross cash income per farm for the years 1905-1909 was \$2,894.78 and \$2,815.26, respectively. Placed upon the basis of gross cash sales per acre, the sales at Northfield averaged almost three times those at Halstad. The principal reason for this lies not in superior fertility of the soil, quality of the land, or greater progressiveness, but in the greater use of productive live stock on the farm. In the latter instance the products grown on the farm and salable with difficulty at very low prices were converted into valuable and easily salable products, while on the Halstad route much of these products was necessarily wasted. A high gross income does not always indicate greater net profit. Accompanied by equally skilled methods of management the average net profits accruing from the farm as a whole will be much higher on the farm with greater income. The profit or loss from the dairy enterprise as determined by routes are shown in the appendix and should be used in further interpreting Table XIX.

The percentage of sales from dairy cattle to total sales from the farm at Marshall has been affected in 1908 and 1909 by the inclusion of sales from miscellaneous cattle not from the dairy herd. If we consider during those years only sales from dairy products and cows, the per cent as compared to total farm sales is 9.8 and 9.7, respectively, in 1908 and 1909, thus showing a decrease in the relative income from year to year. This has been due chiefly to larger experimental farms during the years 1908-9 and to roughing stock cattle through the winter or feeding for slaughter.

A marked comparative increase shown in sales from cattle at Halstad in 1906 was due to the practical failure of farm crops on account of excessive moisture. The sales of farm crops were materially decreased while the actual income from cattle was increased.

The importance of the dairy enterprise to the farm is determined by the effect upon income and net profits. Cattle on the farm, in common with other kinds of productive live stock, will almost invariably cause an increase in the gross income of the farm, partly because of the use of products otherwise unsalable. Whether the increase in gross income will be reflected in the net profit depends wholly upon the productivity of the stock. A higher gross income is of no importance save that it indicates that labor or feeds have been made use of, unless net profits show an increase sufficient to maintain the relative net gain on the farm.

The data accumulated show very clearly that under average farm conditions the cost of milk or butter-fat production is high and that, based upon cost alone, the income from products sold is not sufficiently high to cover cost of production. It should be remembered, however, that this investigation is concerned with the cost or income as obtained from groups of farms; that these groups, as nearly representative as can be obtained, are managed by individuals operating the enterprise at varying profits or loss. Some attain a high profit, others invariably operate at a loss, depending upon managerial skill and the productivity of their herds. Averages reflect the practice, usage, and returns from the group, but do not reflect the cost of production that may be attained by the skilled individual manager. The final results show the close relation of the farm dairy, especially when it is operated to produce economically, to profits from the other farm enterprises. Table XIX illustrates the effect of the farm dairy upon gross income from the farm on the three Minnesota routes. The financial results, as shown in the appendix, give the effect that the dairy enterprise has had upon net income irrespective of its relation to fertility of the land or upon crop productions. On the Northfield route, 1905-1909, the net income as obtained from the dairy enterprise, which takes into consideration not only the sales of product, but also profits obtained through the sale of dairy stock, was \$10,444.99, or \$2,089 per year for an average of 116 cows. This profit has been obtained through sales of live stock rather than from the milk, but has had a very marked effect upon the profits of the farm as a whole. At Marshall, 1906-1909, the dairy enterprise was operated at a net loss of \$438.97, or \$109.74 per year, an average of \$2.88 per cow annually. Halstad also showed an operating loss, amounting to \$4,222.19 for 1904-1909, or \$703.70 per year, an average of \$8.91 per cow annually. However, in spite of the operating loss in direct income, due chiefly to uneconomical forms of production, the dairy enterprise has aided materially in making the farm business, as a whole, more profitable. Detailed study of cost of production and of the items of cost which affect efficiency, hence the cost of production per unit of product, indicates clearly the possibilities of direct profit that may be obtained from this enterprise.

APPENDIX.

FINANCIAL STATEMENT OF MISCELLANEOUS CATTLE.

The miscellaneous cattle—calves, yearlings, heifers, steers, and bulls, not used as herd bulls—are in this bulletin considered an enterprise separate from the dairy. Calves at birth have been transferred to the miscellaneous cattle enterprise with no cash charge. All expenditures for feed, labor, etc., for this class of stock have been charged to this enterprise and credit has been given it for products sold, used in the household and for transfers to the dairy.

A small proportion of the miscellaneous stock raised has finally been taken into the dairy herd, much the larger proportion having been used for meat, especially at Marshall and Halstad. At Northfield in the last two or three years most of the heifer calves were sold for dairy purposes and the better bulls raised and sold as sires; the poorer stock were sold for veal, given away, or killed soon after birth.

Table I shows the large number of miscellaneous stock per farm at Marshall and Halstad as compared with the number of cows. Northfield farms keep a smaller number in comparison with the cows, indicating that young stock is kept more closely sold off and is not reared except with a profitable end in view. At Marshall and Halstad, on the contrary, stock is grown to $1\frac{1}{2}$ to $2\frac{1}{2}$ years of age before being sold. It is then sold at beef or feeder prices which, at Halstad especially, are very low, due to the fact that markets for live stock have not been well developed in that territory.

Loss or gain on miscellaneous cattle apparently depends upon the proper care and feeding of the stock and on the price realized rather than on breed. Most young stock on the farm are notoriously poorly fed and cared for, whether being raised for the milking herd or for ultimate sale as beef. In many cases calves are carried through the winter with practically no gain and are stunted and unable to make proper gains when put on pasture or feed. The result is a high cost of production, compared to the price obtained from these light and oftentimes inferior cattle.

Apparently there is no reason why the young stock on farms should be produced at a loss. Good business methods, proper feeding and care, and consideration of the relationship of cost and market price should enable the producer, even under average conditions, to either eliminate or reduce losses to a minimum. It is mostly a question of economies. Methods of feeding and of care are well worked out so that their application can readily be made. To produce profitably, one has only to apply these principles and an understanding of cost of production, so that stock will not be carried beyond the time they will give a profitable return.

Cheap, rough feeds, pasture, and small amounts of grain are grown in sufficient quantity on most farms to nourish all kinds of young stock and cause them to make reasonable gains. The cattle industry from the viewpoint of the management of young stock needs careful study. Many farmers say they can not afford to raise the stock needed to renew their herd because they can purchase the mature animal more cheaply than they can raise it, thus transferring the money loss to another individual or purchasing in a section well adapted to the production of young stock and which may raise stock to maturity for regions unable to do so with profit.

An industry in which the offspring is sold at prices which are unremunerative can not permanently exist unless it has some other industry to support it. For many years the dairy industry will doubtless continue to be largely dependent upon the common cow, producing on an average during her productive life seven or eight calves, one-half of which will probably be heifers. Not more than one-half of these will be sufficiently productive to replace and improve the dam. Few of the bulls will be salable or fit for sires. Thus on the average farm the larger proportion of the offspring, over one-half, must be sold either for veal, beef, or stockers.

It is essential that this class of stock be raised at a profit or at least sold at a price sufficient to cover the cost of production. Otherwise the loss must ultimately be paid by the dairy industry, and the cost of its products would increase accordingly.

The following tables present the financial statement for miscellaneous live stock by years and by routes, with the exception of 1908 and 1909 at Marshall. The items comprising the statement are similar to and obtained by the same methods as the items of similar tables on the dairy industry, excepting that decreases in inventory values from year to year are taken into consideration rather than depreciation.

Growing young stock do not suffer depreciation because of constant increase in value due to approaching maturity. Losses, however, occur through death, etc.

Labor and feeds have been charged at the same relative prices as in the dairy enterprise.

MISCELLANEOUS CATTLE AT NORTHFIELD.

FINANCIAL STATEMENT 1905.

EXPENSE.

	DR.	CR.
To cash feeds (1,404 pounds bran, 657 pounds linseed-oil meal)-----	\$21. 90	
To farm feeds (317,449 pounds roughage, 47,561 pounds grains, 19,304 pounds whole and skim milk, 13,365 days' pasture)-----	1, 107. 20	
To labor (man, 1,476½ hours; horse, 225 hours)-----	245. 00	
To general expense (see p. 21)-----	111. 14	
To shelter (equivalent to 45 head mature cattle at \$2.46 each)-----	110. 70	
To interest on investment (5 per cent)-----	55. 01	

RECEIPTS.

	DR.	CR.
By cash (sale of beef, veal, and live stock)-----		\$610. 01
By live stock (transfer of 7 heifers to dairy herd)-----		545. 00
By receipts from operation-----		1, 155. 01
By live stock (increase by appreciation)-----		98. 85
Total expense-----	\$1, 656. 95	
Total receipts-----		1, 253. 86
Balance-----		403. 09
Loss-----	1, 656. 95	1, 656. 95
	403. 09	

INVENTORY.

Opening inventory (61 head)-----		1, 100. 25
Cash additions-----		332. 90
Live stock (value increase by appreciation)-----		98. 85
Balance-----	1, 532. 00	
Closing inventory (76 head)-----	1, 532. 00	1, 532. 00

FINANCIAL STATEMENT 1906.

EXPENSE.

To cash sundries-----	\$0. 50
To cash feeds (27,895 pounds bran and linseed-oil meal) --	33. 84
To farm feeds (247,129 pounds roughage, 14,890 pounds grains, 18,817 pounds skim milk, 11,828 days' pasture) --	1, 085. 36
To labor (man, 212 hours; horse, 53 hours)-----	296. 40
To general expense (see p. 21)-----	45. 19
To shelter (equivalent to 55 head mature cattle, at \$2.46 each)-----	135. 30
To interest on investment (5 per cent)-----	73. 25

RECEIPTS.

By cash (sales of beef, veal, hides, and live stock)-----		\$711. 00
By live stock (28 heifers transferred to dairy herd)-----		980. 00
Total expense-----	1, 669. 84	
Loss in inventory-----	351. 00	
Total receipts-----		1, 691. 00
Balance-----		329. 84
Loss-----	2, 020. 84	2, 020. 84
	329. 84	

INVENTORY.

Opening inventory (85 head)-----		1, 465. 00
Cash additions (calves and young bulls)-----		136. 00
Loss-----	351. 00	
Balance-----	1, 250. 00	
Closing inventory (81 head)-----	1, 601. 00	1, 601. 00
		1, 250. 00

¹Affected by sale of young stock with cows. See Dairy Enterprise, 1905.

FINANCIAL STATEMENT, 1907.

EXPENSE.

	Dr.	Cr.
To cash sundries-----	\$1. 90	
To cash feeds (196 pounds blood meal, 1,977.5 pounds linseed-oil meal, 451 pounds bran)-----	38. 59	
To farm feeds (179,422 pounds roughage, 47,089 pounds grains, 19,715 pounds whole and skim milk, 12,342 days' pasture)-----	1, 138. 07	
To labor (man, 216 hours; horse, 54 hours)-----	294. 30	
To general expense (see p. 21)-----	32. 11	
To shelter (equivalent to 49 head mature cattle, at \$2.46 each)-----	120. 54	
To interest on investment (5 per cent)-----	43. 90	

RECEIPTS.

By cash (sale of beef, veal, hides, and young cattle for breeding purposes)-----	\$1, 131. 40	
By live stock (7 heifers transferred to dairy herd)-----	245. 00	
Receipts from operation-----	1, 376. 40	
By live stock (value increased by appreciation)-----	663. 75	
Total expense-----	1, 669. 41	
Total receipts-----		2, 040. 15
Balance-----	370. 74	
	2, 040. 15	2, 040. 15
Gain-----		370. 74

INVENTORY.

Opening inventory (74 head)-----		878. 00
Cash additions (calves)-----		94. 25
Live stock (increase by appreciation)-----		663. 75
Balance-----	1, 636. 00	
	1, 636. 00	1, 636. 00
Closing inventory (74 head)-----		1, 636. 00

FINANCIAL STATEMENT, 1908.

EXPENSE.

To cash feeds (3,411 pounds of bran and linseed-oil meal)-----	\$59. 45	
To farm feeds (230,094 pounds roughage, 20,901 pounds grains, 19,443 pounds whole and skim milk, 12,628 days' pasture)-----	1, 302. 61	
To labor (man, 2,000 hours; horse, 500 hours)-----	336. 70	
To general expense (see p. 21)-----	61. 43	
To shelter (equivalent to 58 head mature cattle, at \$2.46 each)-----	142. 68	
To interest on investment (5 per cent)-----	86. 55	

RECEIPTS.

By cash (sales of beef, veal, hides, and young stock for breeding purposes)-----	\$2, 904. 06	
By live stock (27 heifers transferred to dairy herd)-----	1, 485. 00	
Total expense-----	1, 989. 42	
Total receipts-----		4, 389. 06
Loss in inventory-----	2, 560. 00	
Balance-----		160. 36
	4, 549. 42	4, 549. 42
Loss-----	160. 36	

INVENTORY.

	Dr.	Cr.
Opening inventory (82 head)-----		\$1,731.00
Cash additions (59 head)-----		4,015.00
Loss -----	2,560.00	
Balance -----	3,186.00	
	5,746.00	5,746.00
Closing inventory (92 head)-----		3,186.00

FINANCIAL STATEMENT, 1909.

EXPENSE.

To cash sundries (freight crates, bull ring, etc.)-----	\$108.12
To cash feeds (2,553 pounds bran and linseed-oil meal, 2,589 pounds mill feeds)-----	127.71
To farm feeds (210,973 pounds roughage, 24,158 pounds grains, 43,725 pounds milk, 11,532 days' pasture)-----	1,349.01
To labor (man, 1,960 hours; horse, 490 hours)-----	344.55
To general expense (see p. 21)-----	67.57
To shelter (equivalent to 61 head mature cattle, at \$2.46 each) -----	150.06
To interest on investment (5 per cent)-----	165.30

RECEIPTS.

By cash (sales of beef, veal, and breeding stock)-----	\$2,862.46
By live stock (15 heifers transferred to dairy herd)-----	900.00
Total expense-----	2,312.32
Total receipts-----	3,762.46
Loss in inventory-----	570.50
Balance -----	879.64
	3,762.46 3,762.46
Gain -----	879.64

INVENTORY.

Opening inventory (86 head)-----	3,306.00
Cash additions (44 head)-----	4,777.50
Loss -----	570.50
Balance -----	7,513.00
	8,083.50 8,083.50
Closing inventory (99 head)-----	7,513.00

The profits from miscellaneous live stock at Northfield, owing to the increased number of pure-bred stock, show remarkable gains. The year 1905 was the beginning of the pure-bred stock industry in that locality. Previously, few animals were sold for other than veal or beef, but since that date the herds have been graded up. Good sires have been kept on nearly all farms and an effort has been made to improve materially the class of cattle kept. During the same time a movement began to make Northfield a center for Holsteins, and the vicinity is now noted for its high quality of this breed. Several excellent herds have been sold to outside buyers at remunerative prices.

The profits from miscellaneous stock have increased from year to year, as better-bred stock have been raised and the locality has become better advertised.

Whole milk having been the principal product sold from this district, small quantities have been available for the rearing of calves or other live stock. Compared to skim milk, the quantities fed have been high in price. When whole milk is fed to calves the price has been that which could be obtained on the market. By reason of the comparatively high price and ready sale for whole milk on the

Northfield route only small quantities were fed there, while on other routes skim milk was largely used.

The use of skim milk and cheaper forms of roughage would result in cheapening the cost of maintenance and increasing the possible profits from the miscellaneous live stock. Profits from this class of stock have been further affected by purchases and resales. This has in many cases been very profitable, as large increases were secured and the expense of maintenance was comparatively small. However, whatever profit is secured from miscellaneous cattle must come, in most communities, from growing them rather than from purchase from other breeders and sale at higher prices. From present data, it is impossible to state with exactness the profits made from growing and selling the stock. Until 1908 and 1909 the additions through cash purchases were comparatively small, and the business for the three preceding years had been conducted at an average annual loss of \$120.73. During 1908 and 1909 large purchases of stock were made, a total of \$8,729.50 worth in the two years, and cash sales increased correspondingly; the average profit was \$414.14 annually. By analogy, this would indicate that the profits from miscellaneous cattle were obtained by the purchase and resale of stock rather than by raising it. In other words, that the profits have been obtained by speculation rather than by the production and sale of young stock. In this connection it should be noted that the herds were being graded up and improved during the first three years and that prices were then lower. The benefits of the improved herds and higher prices accrued in the years 1908 and 1909.

The effort to ascertain the cost of growing a heifer, bull or steer on these farms was dropped as impracticable. Various experiment stations, however, have kept exact records of cost of food and of food consumed in growing dairy cattle from calves to yearlings. In a recent bulletin by the Michigan experiment station¹ the cost of rearing dairy calves on skim milk and supplementary feed to a year old is given at \$18.30 to \$30.49 per head. Under farm conditions in the Northwest—price of feeds being less—this cost would be considerably discounted. However, there is little doubt that a 2-year old heifer represents a cost of not less than \$30 for feed, and an additional expenditure of \$10 to \$15 for labor, shelter, and milk. It is doubtful if even under ordinary Northwestern farm conditions it is profitable to raise either a 2-year-old heifer or a steer that will bring less than \$40 to \$45.

MISCELLANEOUS CATTLE AT MARSHALL.

FINANCIAL STATEMENT—1906.

EXPENSE.		DR.	CR.
To cash sundries (registration, etc.)-----		\$15. 59	
To farm feeds (165,080 pounds roughage, 50,161 pounds grain, 5,850 pounds whole milk, 68,274 pounds skim milk, 9,277 days' pasture)-----	1, 012. 69		
To labor (man, 1,025 hours; horse, 205 hours)-----	137. 40		
To general expense (see p. 21)-----	20. 23		
To shelter (equivalent to 45 head mature cattle, at \$2.46 each)-----	120. 54		
To interest on investment (5 per cent)-----	64. 25		

¹ Bulletin 257.

RECEIPTS.

	Dr.	Cr.
By cash (sales of beef, calves, 1 bull, etc.)		\$2, 473. 57
By live stock (9 heifers transferred to dairy herd)		175. 00
Total expense	\$1, 370. 70	
Total receipts		2, 648. 57
Loss in inventory	1, 572. 75	
Balance		294. 88
	2, 943. 45	2, 943. 45
Loss	294. 88	

INVENTORY.

Opening inventory (84 head)		1, 285. 00
Cash additions (31 head)		958. 75
Loss	1, 572. 75	
Balance	671. 00	
	2, 243. 75	2, 243. 75
Closing inventory (63 head)		671. 00

FINANCIAL STATEMENT, 1907.

EXPENSE.

To cash sundries	\$6. 00
To cash feeds (90 pounds bran)	. 81
To farm feeds (165,568 pounds roughage, 34,098 pounds grains, 3,270 pounds whole milk, 95,633 pounds skim milk, 13,407 days' pasture)	958. 32
To labor (man, 1,775 hours; horse, 355 hours)	261. 00
To general expense (see p. 21)	18. 76
To shelter (equivalent to 78 head mature cattle, at \$2.46 each)	191. 88
To interest on investment (5 per cent)	76. 65

RECEIPTS.

By cash (sales 14 head live stock, beef, hides, etc.)		\$356. 63
By live stock (transfer 12 heifers to dairy herd)		300. 00
Receipts from operation		656. 63
By live stock (increase by appreciation)		169. 87
Total expense	1, 513. 42	
Total receipts		826. 50
Balance		686. 92
	1, 513. 42	1, 513. 42
Loss	686. 92	

INVENTORY.

Opening inventory (94 head)		1, 533. 00
Cash additions (8 head)		237. 13
Live stock (increase value by appreciation)		169. 87
Balance	1, 940. 00	
	1, 940. 00	1, 940. 00
Closing inventory (142 head)		1, 940. 00

Financial statements for the years 1906 and 1907 only are presented; in the years 1908 and 1909 the data pertaining to the dairy stock have been carried with stock kept for feeding purposes or simply carried through the year for use in feeding.

The miscellaneous cattle on this route were generally disposed of as beef or as feeders, many being sold in the immediate neighborhood; the remainder shipped to some one of the large markets.

A loss is shown for both years. In fact the revenue of the two years little more than covers the cost of feeds and actual cash expense of maintaining the enterprise.

MISCELLANEOUS CATTLE AT HALSTAD.

FINANCIAL STATEMENT, 1904.

	EXPENSE.	Dr.	Cr.
To cash sundries.....		\$1. 75	
To farm feeds (119,183 pounds roughage, 7,939 pounds grains, 139,469 pounds whole and skim milk, 6,630 days' pasture)		681. 34	
To labor (man, 1,545 hours; horse, 257 hours)		201. 80	
To general expense (see p. 21)		34. 70	
To shelter (equivalent to 39 head mature cattle, at \$2.46 each)		95. 94	
To interest on investment (6 per cent)		51. 36	
	RECEIPTS.		
By cash (sales of stock)			\$519. 70
By live stock (12 heifers transferred to dairy herd)			240. 00
Total expense	1, 066. 89		
Total receipts			759. 70
Loss in inventory	220. 00		
Balance			527. 19
	1, 286. 89	1, 286. 89	
Loss	527. 19		
	INVENTORY.		
Opening inventory (76 head)			856. 00
Loss	220. 00		
Balance	636. 00		
	856. 00	856. 00	
Closing inventory (74 head)			636. 00

FINANCIAL STATEMENT, 1905.

	EXPENSE.		
To cash feeds (50 pounds linseed-oil meal)	\$1. 00		
To farm feeds (147,276 pounds roughage, 9,940 pounds grains, 4,740 pounds whole milk, 105,762 pounds skim milk, 5,017 days' pasture)	558. 89		
To labor (man, 1,113 hours; horse, 158 hours)	144. 00		
To general expense (see p. 21)	24. 08		
To shelter (equivalent to 35 head mature cattle at \$2.46 each)	86. 10		
To interest on investment (6 per cent)	27. 84		
	RECEIPTS.		
By cash (sales of stock)		\$632. 27	
By live stock (1 heifer transferred to dairy herd)		23. 00	
Receipts from operation		655. 27	
By live stock (increase by appreciation)		36. 50	
Total expense	841. 91		
Total receipts		691. 77	
Balance		150. 14	
	841. 91	841. 91	
Loss	150. 14		

INVENTORY.

	Dr.	Cr.
Opening inventory (54 head)-----		\$464.00
Cash additions (2 bulls)-----		78.00
Live stock (increase by appreciation)-----		36.50
Balance-----	\$578.50	
	578.50	578.50
Closing inventory (51 head)-----		578.50

FINANCIAL STATEMENT, 1906.

EXPENSE.

To cash sundries-----	\$0.70
To cash feeds (14 pounds blood meal, 161 pounds shorts, 60 pounds linseed-oil meal)-----	2.60
To farm feeds (299,810 pounds roughage, 19,313 pounds grains, 15,339 pounds whole milk, 176,424 pounds skim milk, 14,991 days' pasture)-----	1,230.29
To labor (man, 2,604 hours; horse, 434 hours)-----	329.62
To general expense (see p. 21)-----	56.70
To shelter (equivalent to 78 head mature cattle, at \$2.46 each)-----	191.88
To interest on investment (6 per cent)-----	52.38

RECEIPTS.

By cash (sales beef, veal, hides, and live stock)-----	\$927.12
By live stock (3 heifers transferred to dairy herd)-----	69.00
Receipts from operation-----	996.12
By live stock (increase by appreciation)-----	255.35
Total expense-----	1,864.17
Total receipts-----	1,251.47
Balance-----	612.70
	1,864.17
Loss-----	612.70

INVENTORY.

Opening inventory (127 head)-----	873.00
Cash additions (1 head)-----	15.15
Live stock (increase by appreciation)-----	255.35
Balance-----	1,143.50
	1,143.50
Closing inventory (108 head)-----	1,143.50

FINANCIAL STATEMENT, 1907.

EXPENSE.

To cash sundries-----	\$4.10
To cash feeds (1,036 pounds bran)-----	7.60
To farm feeds (332,186 pounds roughage, 55,957 pounds grains, 11,426 pounds whole milk, 13,751 pounds skim milk, 2,448 days' pasture)-----	1,409.45
To labor (man, 2,716 hours; horse, 388 hours)-----	347.99
To general expense (see p. 21)-----	31.22
To shelter (equivalent 76 head mature cattle at \$2.46 each)-----	186.96
To interest on investment (6 per cent)-----	66.54

RECEIPTS.

	Dr.	Cr.
By cash (sales of beef and live stock)-----		\$738. 78
By live stock (19 heifers transferred to dairy herd)-----		437. 00
Total expense-----	\$2, 053. 86	
Total receipts-----		1, 175. 78
Loss in inventory-----	19. 00	
Balance-----		897. 08
Loss-----	2, 072. 86	2, 072. 86
	897. 08	

INVENTORY.

Opening inventory (116 head)-----		1, 109. 00
Loss-----	19. 00	
Balance-----	1, 090. 00	
	1, 109. 00	1, 109. 00
Closing inventory (114 head)-----		1, 090. 00

FINANCIAL STATEMENT, 1908.

EXPENSE.

To cash sundries-----	\$19. 40
To farm feeds (314,646 pounds roughage, 13,432 pounds grains, 2,762 pounds whole milk, 109.023 pounds skim milk, 23,209 days' pasture)-----	1, 294. 66
To labor (man, 2,230 hours; horse, 223 hours)-----	323. 38
To general expense (see p. 21)-----	55. 94
To shelter (equivalent to 72 head mature cattle at \$2.46 each)-----	177. 12
To interest on investment (6 per cent)-----	64. 92

RECEIPTS.

By cash (sales of beef, veal, hides, and live stock)-----	810. 47
By live stock (19 heifers transferred to dairy herd)-----	437. 00
Receipts from operation-----	1, 247. 47
By live stock (increase by appreciation)-----	141. 65
Total expense-----	1, 935. 42
Total receipts-----	1, 389. 12
Balance-----	546. 30
Loss-----	1, 935. 42
	546. 30

INVENTORY.

Opening inventory (114 head)-----	1, 082. 00
Cash additions (4 head)-----	88. 35
Live stock (increase by appreciation)-----	141. 65
Balance-----	1, 312. 00
	1, 312. 00
Closing inventory (103 head)-----	1, 312. 00

FINANCIAL STATEMENT, 1909.

EXPENSE.

To cash sundries-----	\$0. 55
To cash feeds (125 pounds bran)-----	1. 20
To farm feeds (317,347 pounds roughage, 21,075 pounds grains, 3,256 pounds whole milk, 162,597 pounds skim milk, 18,849 days' pasture)-----	1, 476. 11
To labor (man, 2,230 hours; horse, 223 hours)-----	321. 24
To general expense (see p. 21)-----	84. 26
To shelter (equivalent to 72 head mature cattle at \$2.46 each)-----	177. 12
To interest on investment (6 per cent)-----	68. 04

RECEIPTS.

	Dr.	Cr.
By cash (sales of stock)-----		\$1, 186. 31
By live stock (11 heifers transferred to dairy herd)-----		275. 00
<hr/>		
Total expense-----	\$2, 128. 52	
Total receipts-----		1, 461. 31
Loss in inventory-----	3. 00	
Balance-----		670. 21
<hr/>		
Loss-----	2, 131. 52	2, 131. 52
	670. 21	

INVENTORY.

Opening inventory (103 head)-----		1, 134. 00
Cash additions (10 head)-----		204. 00
Loss-----	3. 00	
Balance-----	1, 335. 00	
<hr/>		
	1, 338. 00	1, 338. 00
Closing inventory (115 head)-----		1, 335. 00

The miscellaneous cattle at Halstad, of much the same character as those in the newer sections attempting dairying, are maintained under similar conditions. The cows are from common stock and show an intermixture of breeds. On account of distance from important markets and the comparatively small amount of stock raised local markets have not been developed to any great extent and prices are low.

The young stock has not generally been given the care or the feed conducive to the best growth and quality. Practically all stock sold has been for slaughter, although in 1908 and 1909 several head were sold for use in the dairy.

The purchase of stock has been very small, principally bulls or bull calves. All sales, with few exceptions, have been of stock produced and reared on the farm.

The tables for a series of years show well the losses that may be expected at prices which have prevailed in rearing the ordinary class of young stock. While it is true that by proper feeding and care losses might have been materially reduced, yet even with the best management much higher prices would have to be received in order to obtain a profit. Under conditions of this kind, apparently the only possible method of eliminating these losses is by selling the calves for veal and raising only the stock necessary to build up the herd. The poorer stock would thereby be disposed of before accumulating great loss and the herd of dairy cattle would be improved by raising the better-bred calves.

The data accumulated on the three routes for a series of years show that, under average farm conditions, the young stock is still kept at a loss, despite the fact that all industries have shown gains and, through economies or higher prices, have succeeded in establishing a materially better condition. Apparently the cost of rearing stock is so much greater than the price received therefrom that under farm conditions losses on this enterprise will inevitably occur.

To prevent this condition, so far as possible, is desirable. It may be done by greater care and economy in feeding—not close-fisted

economy, but one based on a knowledge of proper feeding methods—by breeding better cattle, by more careful study of the economics of the industry, and by promptly preventing undue loss by early sales.

Evidence shows that better breeding of the herd makes it possible to decrease losses and eventually to turn loss into gain. While conditions may exist under which a farmer can well afford to keep live stock at an apparent loss, because feeds too bulky to market to advantage, or unmarketable, may be fed to them remuneratively, or because the manure may be considered a sufficient return to offset the loss, yet it is unnecessary and unbusinesslike to carry on this enterprise of the farm at an actual loss.

Increased land values and permanently higher cost of feed and labor would tend to accentuate this difficulty, so that relief may be expected only by a change in the industry itself or by materially higher prices.

The difficulty of profitably producing young stock is recognized by the farmers of the Central West, as is indicated by the increased number of native calves which have arrived at the markets the past few years. The number of calves sold for veal from dairy sections has, it is commonly observed, been on the increase. In many instances the sale of calves from the dairy districts has been so great that insufficient young stock has been raised to keep up the herds, and the purchase of cows from other localities has been necessary. When the price of native calves is compared with the price of feeders, stockers, or even common dairy cows, and at the same time cost of production is considered, the reason for close sales is easily seen. During 1904 to 1909, inclusive, the average monthly price of native calves on the Chicago market ranged from \$5.60 to \$7.10 per hundred pounds. At these prices calves may be sold at a fair profit, while, if raised to maturity, the cost of production is generally as great or greater than the return.

DETAILED FINANCIAL CONSUMPTION AND PRODUCTION ACCOUNTS FOR DAIRY ENTERPRISE.

FOOD CONSUMPTION AND PRODUCTION.

Table XX shows in detail the food consumption on all farms, by months and by years, the kinds of feed, the number of cows, also the production of milk or butter fat each month as determined by weight and test with the Babcock machine. The tables are self-explanatory and designed especially for those desiring to make other studies of the dairy industry than those contained in this bulletin.

Cows.—The number of milch cows is the number in the herd used for milk purposes and comprises both fresh and dry cows.

Roughage.—All roughage fed, excepting straw, for which no charge is made has been included. It comprises all kinds of hay (timothy and clover predominating) corn fodder, eared-corn fodder, silage, shredded stover, and all other roughage fed.

Farm grains.—All grains fed which are raised on the farm—oats, corn, barley, spelt, rye, etc., as differentiated from bran or oil meal. Oats, corn and barley predominate as feed, forming over 98 per cent of the total farm grains fed. Shorts, middlings, gluten feed,

or other kinds of mill feed have been classed as either bran or oil meal, depending on their protein content. However, very small quantities of mill feeds other than bran or oil meal have been fed.

Days of pasture.—Number of days of pasture in terms of a single cow. For example, if 10 cows are pastured 30 days, it is reported as 300 days of pasture.

Cash value of feeds.—The value of all feeds consumed, roughage, farm grains, mill feeds, and pasturage.

TABLE XX.—*Food consumption and production of milk and butter fat, by months.*

NORTHFIELD, 1905.

Month.	Milch cows.	Consumption and value.						Production.	
		Roughage.	Farm grains.	Bran.	Linseed-oil meal.	Pasture.	All feeds.	Milk.	Butter-fat.
	No.	Pounds.	Lbs.	Pounds.	Pounds.	Days.	Dollars.	Pounds.	Lbs.
January.....	129	137,077	11,199	7,354	31	.....	414.62	50,791	1,993
February.....	130	121,723	11,341	3,356	120	.....	397.82	49,805	1,941
March.....	127	137,064	15,474	5,549	186	.....	470.53	58,623	2,155
April.....	130	113,979	15,975	6,965	45	.....	421.36	58,064	1,991
May.....	125	33,758	8,201	2,435	60	2,750	252.82	73,609	2,573
June.....	125	600	430	.....	.....	3,750	136.69	76,594	2,642
July.....	121	620	217	.....	.....	3,751	124.45	63,736	2,286
August.....	121	930	359	.....	.....	3,751	126.57	43,967	1,690
September.....	117	8,600	.....	.....	.....	3,510	131.58	46,141	1,706
October.....	115	11,105	496	.....	.....	3,350	145.07	50,240	1,945
November.....	120	57,829	1,008	6,720	.....	.....	155.01	47,797	1,876
December.....	124	169,095	9,798	5,860	.....	.....	396.43	43,712	1,682
Total.....	.....	792,320	74,498	38,239	442	20,862	3,172.95	663,079	24,480

NORTHFIELD, 1906.

January.....	124	126,766	7,127	10,055	.....	.....	335.91	42,095	1,566
February.....	127	108,090	7,420	7,222	.....	.....	346.13	41,812	1,593
March.....	126	125,014	12,563	7,812	.....	.....	418.42	53,918	1,962
April.....	133	110,410	11,280	6,600	.....	.....	441.33	56,823	1,991
May.....	134	25,715	3,720	1,810	.....	2,815	226.12	71,723	2,582
June.....	133	.....	.....	.....	.....	4,050	133.00	69,329	2,377
July.....	131	.....	.....	.....	.....	4,061	131.00	61,050	2,189
August.....	132	.....	.....	.....	.....	4,092	132.00	49,778	1,946
September.....	132	.....	.....	.....	.....	3,979	132.00	47,291	1,819
October.....	135	11,232	240	.....	.....	4,123	168.88	49,031	1,838
November.....	131	52,280	1,740	1,390	.....	1,505	235.10	41,538	1,571
December.....	130	117,361	9,796	4,278	164	.....	418.49	46,262	1,754
Total.....	.....	676,868	53,886	39,167	164	24,625	3,118.38	630,650	23,188

NORTHFIELD, 1907.

January.....	119	94,519	15,977	4,144	387	.....	400.43	48,848	1,794
February.....	121	90,502	16,016	5,376	168	.....	436.74	46,217	1,648
March.....	119	87,698	12,997	6,572	62	.....	357.80	51,212	1,762
April.....	120	82,100	15,464	4,824	.....	.....	489.38	51,285	1,729
May.....	119	45,027	9,952	2,488	.....	1,266	297.59	52,816	1,835
June.....	117	.....	.....	.....	.....	3,480	116.00	65,205	2,248
July.....	113	.....	.....	.....	.....	3,468	114.20	63,248	2,131
August.....	114	.....	.....	.....	.....	3,390	110.78	49,355	1,765
September.....	110	.....	.....	.....	.....	3,118	109.27	41,455	1,518
October.....	111	15,730	47	.....	.....	3,025	152.91	39,604	1,484
November.....	112	37,633	903	536	244	.....	116.46	32,653	1,160
December.....	112	106,066	1,498	2,602	868	.....	320.90	36,201	1,317
Total.....	.....	559,275	72,854	26,542	1,729	17,747	3,022.46	578,099	20,391

TABLE XX.—Food consumption and production of milk and butter fat, by months—Continued.

NORTHFIELD, 1908.

Month.	Milch cows.	Consumption and value.						Production.	
		Rough-age.	Farm grains.	Bran.	Linseed-oil meal.	Pasture.	All feeds.	Milk.	Butter-fat.
	No.	Pounds.	Lbs.	Pounds.	Pounds.	Days.	Dollars.	Pounds.	Lbs.
January.....	107	95,328	7,715	2,752	1,581	.....	431.63	41,071	1,435
February.....	110	96,592	7,598	6,600	2,040	.....	456.50	50,774	1,779
March.....	104	108,264	6,998	7,768	1,116	.....	487.89	51,686	1,762
April.....	107	98,516	5,632	4,710	1,068	.....	454.95	48,724	1,715
May.....	107	36,158	2,184	2,572	308	2,049	261.12	61,175	2,146
June.....	101	.....	.....	.....	.....	3,030	101.00	64,947	2,296
July.....	101	.....	.....	.....	.....	3,118	101.00	48,605	1,876
August.....	100	3,100	.....	.....	.....	3,100	100.00	43,709	1,612
September.....	101	6,464	1,108	.....	.....	3,030	130.06	42,490	1,558
October.....	106	27,816	2,100	1,775	433	2,769	186.52	46,766	1,658
November.....	103	69,278	2,749	3,240	2,633	.....	265.63	40,797	1,437
December.....	114	143,332	9,379	6,017	434	.....	425.08	52,940	1,873
Total.....	.....	684,848	45,463	35,434	9,613	17,096	3,401.38	593,684	21,147

NORTHFIELD, 1909.

January.....	117	128,475	11,704	3,909	.....	.....	339.44	55,490	1,910
February.....	116	106,989	6,958	4,002	980	.....	268.35	51,274	1,726
March.....	117	113,518	6,302	8,372	118	.....	329.00	55,884	1,906
April.....	106	93,796	6,740	6,733	1,305	.....	313.62	52,264	1,708
May.....	105	55,917	6,227	2,900	465	1,547	246.72	50,730	1,751
June.....	102	.....	.....	.....	.....	2,880	89.00	67,830	2,218
July.....	104	.....	.....	.....	.....	3,043	91.67	55,483	1,867
August.....	101	.....	.....	.....	.....	2,914	89.00	35,089	1,232
September.....	98	4,200	.....	.....	.....	2,783	100.60	28,971	1,017
October.....	88	30,519	400	105	.....	1,932	115.70	31,534	1,144
November.....	89	49,213	2,715	2,812	390	779	132.48	35,601	1,215
December.....	93	92,315	26,301	4,776	1,100	.....	262.11	43,181	1,439
Total.....	.....	674,942	67,347	33,609	4,358	15,878	2,377.69	563,331	19,133

MARSHALL, 1906.

January.....	53	18,132	6,980	.....	.....	.....	96.12	13,694	560
February.....	53	21,724	6,628	.....	.....	.....	101.63	11,550	456
March.....	53	36,164	8,559	.....	.....	.....	99.62	10,624	418
April.....	52	18,210	6,834	.....	.....	.....	131.42	12,717	468
May.....	52	6,652	11,802	.....	.....	1,168	112.87	19,001	692
June.....	55	.....	4,283	980	.....	1,612	83.84	21,772	783
July.....	57	525	425	.....	.....	1,746	46.72	20,245	734
August.....	51	1,534	796	.....	.....	1,581	46.22	17,068	642
September.....	50	3,149	948	.....	.....	1,497	48.28	15,841	602
October.....	51	18,895	272	.....	.....	1,467	58.22	12,868	525
November.....	52	29,508	2,014	.....	.....	.....	87.40	11,532	458
December.....	52	23,869	5,420	776	.....	.....	78.66	11,209	457
Total.....	.....	178,362	54,961	1,756	.....	9,071	991.00	178,121	6,795

MARSHALL, 1907.

January.....	52	30,178	7,347	.....	180	.....	113.62	14,778	579
February.....	49	33,429	7,272	.....	.....	.....	121.75	12,263	661
March.....	58	26,894	12,959	2,083	.....	.....	180.83	21,128	764
April.....	62	33,100	16,976	2,000	.....	63	268.32	20,499	709
May.....	62	21,806	10,582	2,950	.....	380	182.14	21,059	768
June.....	64	1,300	1,151	573	.....	1,899	64.75	24,972	928
July.....	64	.....	329	.....	.....	1,829	49.93	24,885	958
August.....	64	.....	.....	.....	.....	1,984	49.00	22,719	937
September.....	64	3,645	270	.....	.....	2,020	58.22	15,867	681
October.....	64	29,589	219	.....	.....	1,930	104.96	14,227	595
November.....	62	38,070	1,768	200	.....	.....	94.58	11,182	479
December.....	62	46,230	5,206	1,980	.....	.....	172.25	16,720	720
Total.....	.....	264,241	64,079	9,786	180	10,105	1,460.38	220,299	8,779

TABLE XX.—Food consumption and production of milk and butter fat, by months—Continued.

MARSHALL, 1908.

Month.	Milch cows.	Consumption and value.						Production.	
		Roughage.	Farm grains.	Bran.	Linseed-oil meal.	Pasture.	All feeds.	Milk.	Butter-fat.
	No.	Pounds.	Lbs.	Pounds.	Pounds.	Days.	Dollars.	Pounds.	Lbs.
January.....	17	12, 174	860	500	.....	.....	43. 93	7, 263	287
February.....	17	13, 381	2, 328	1, 300	.....	.....	71. 32	8, 278	321
March.....	17	13, 290	2, 764	400	.....	.....	68. 29	9, 279	395
April.....	17	9, 000	2, 715	300	.....	.....	57. 58	8, 063	348
May.....	22	1, 920	250	.....	.....	682	23. 56	11, 185	489
June.....	22	.....	.....	.....	.....	660	16. 50	8, 768	408
July.....	22	.....	.....	.....	.....	682	16. 50	7, 559	333
August.....	22	.....	.....	.....	.....	682	15. 75	5, 840	270
September.....	18	.....	.....	.....	.....	540	13. 50	4, 142	199
October.....	18	.....	.....	.....	.....	682	13. 50	5, 683	221
November.....	18	4, 949	210	400	.....	.....	27. 13	4, 061	170
December.....	16	12, 189	1, 550	1, 300	.....	.....	58. 61	9, 901	437
Total.....	.....	66, 903	10, 677	4, 200	.....	3, 928	426. 17	90, 022	3, 878

MARSHALL, 1909.

January.....	17	13, 184	632	500	.....	.....	39. 11	9, 676	407
February.....	17	12, 416	949	1, 400	.....	.....	66. 26	8, 666	355
March.....	17	13, 060	1, 476	1, 500	.....	.....	60. 58	9, 073	380
April.....	17	12, 720	626	1, 200	.....	.....	47. 81	7, 053	293
May.....	17	4, 720	592	.....	.....	311	27. 05	8, 249	322
June.....	23	.....	.....	.....	.....	671	16. 78	9, 712	316
July.....	21	.....	.....	.....	.....	651	15. 75	8, 427	267
August.....	20	.....	.....	.....	.....	620	15. 00	6, 032	211
September.....	20	.....	.....	.....	.....	600	15. 00	4, 670	171
October.....	20	200	128	200	.....	620	19. 10	3, 654	128
November.....	18	8, 208	856	200	.....	.....	41. 98	4, 570	143
December.....	20	9, 683	1, 483	1, 000	.....	.....	50. 75	6, 023	204
Total.....	.....	74, 191	6, 742	6, 000	.....	3, 873	415. 17	85, 805	3, 197

HALSTAD, 1904.

January.....	62	47, 901	3, 521	.....	.....	.....	130. 17	9, 508	373
February.....	66	47, 371	3, 887	200	.....	.....	138. 56	12, 320	465
March.....	66	49, 201	9, 585	400	.....	.....	160. 97	15, 723	590
April.....	69	41, 445	5, 358	400	.....	.....	120. 15	15, 393	592
May.....	71	10, 687	2, 783	.....	.....	1, 397	75. 13	21, 357	824
June.....	69	.....	468	.....	.....	2, 160	58. 19	30, 401	1, 150
July.....	69	1, 444	100	.....	.....	2, 228	58. 25	33, 605	1, 254
August.....	71	12, 164	3, 182	.....	.....	2, 321	75. 25	31, 154	1, 190
September.....	70	19, 550	5, 737	.....	.....	1, 920	91. 29	25, 445	974
October.....	69	38, 423	646	.....	.....	1, 626	97. 24	20, 489	879
November.....	70	41, 526	1, 072	.....	.....	90	74. 91	15, 438	684
December.....	66	44, 978	6, 441	.....	.....	.....	84. 33	13, 044	605
Total.....	.....	354, 690	42, 780	1, 000	.....	11, 742	1, 164. 44	243, 877	9, 580

HALSTAD, 1905.

January.....	59	55, 857	2, 751	.....	.....	.....	104. 76	11, 820	517
February.....	57	47, 884	3, 209	.....	.....	.....	94. 98	10, 147	419
March.....	57	43, 478	4, 479	.....	.....	.....	95. 10	11, 965	484
April.....	57	30, 415	5, 385	.....	.....	.....	85. 64	13, 481	530
May.....	56	20, 852	5, 151	199. 2	.....	374	81. 51	20, 095	749
June.....	52	636	1, 273	.....	.....	1, 530	48. 32	25, 696	953
July.....	52	.....	1, 374	.....	.....	1, 546	48. 32	26, 555	973
August.....	52	.....	693	.....	.....	1, 612	43. 94	24, 248	928
September.....	50	10, 779	1, 020	.....	.....	1, 474	55. 94	21, 461	830
October.....	50	30, 464	1, 054	.....	.....	1, 333	71. 92	18, 235	741
November.....	48	36, 389	1, 547	.....	.....	.....	52. 40	11, 620	486
December.....	49	42, 761	3, 253	.....	.....	.....	67. 57	9, 640	464
Total.....	.....	319, 515	31, 189	199. 2	.....	7, 869	850. 40	204, 963	8, 074

TABLE XX.—Food consumption and production of milk and butter fat, by months—Continued.

HALSTAD, 1906.

Month.	Milch cows.	Consumption and value.						Production.	
		Roughage.	Farm grains.	Bran.	Linseed-oil meal.	Pasture.	All feeds.	Milk.	Butter-fat.
	No.	Pounds.	Lbs.	Pounds.	Pounds.	Days.	Dollars.	Pounds.	Lbs.
January.....	96	88,344	11,245				206.00	27,351	1,075
February.....	95	96,014	10,750				186.20	25,200	957
March.....	98	94,518	22,207				236.95	27,609	1,036
April.....	97	87,695	12,798			180	205.17	27,095	1,013
May.....	96	41,585	7,930			1,162	139.53	42,122	1,514
June.....	96		1,421	960		2,640	88.47	42,589	1,591
July.....	96		165			3,007	74.18	41,293	1,525
August.....	96		155			3,007	74.10	38,243	1,498
September.....	95	2,340	210			3,134	79.95	32,583	1,300
October.....	90	15,790	1,009	360		1,333	67.21	27,967	1,208
November.....	88	75,516	5,820	1,476			157.03	24,837	1,039
December.....	85	60,722	11,602	2,589			189.38	23,054	951
Total.....		562,524	85,312	5,325		14,463	1,704.20	380,003	14,707

HALSTAD, 1907.

January.....	95	54,560	7,845	2,604			163.63	20,932	863
February.....	96	47,068	10,914	2,637			195.57	25,207	996
March.....	91	60,064	12,012	2,355			240.43	33,940	1,264
April.....	91	58,330	11,572	1,980			246.19	29,604	1,095
May.....	93	36,748	11,280				196.46	30,144	1,131
June.....	96		996			2,820	84.44	42,225	1,694
July.....	94		248			2,901	72.86	42,755	1,650
August.....	94		217			2,907	72.57	42,687	1,666
September.....	94		270			2,857	73.08	30,589	1,288
October.....	93	45,036	248			2,821	128.05	23,571	1,005
November.....	88	59,920	3,120	660			141.03	17,764	753
December.....	91	67,425	4,216	1,660			171.62	23,873	1,052
Total.....		429,151	62,938	11,897		14,306	1,785.93	363,291	14,457

HALSTAD, 1908.

January.....	90	71,970	5,766	918			195.53	23,479	975
February.....	86	76,009	5,841	531			204.88	27,575	1,064
March.....	88	90,186	7,438	403			258.63	35,743	1,431
April.....	85	81,210	9,876	900			238.26	33,808	1,345
May.....	80	47,660	12,824	600			268.93	38,900	1,543
June.....	84					688			
July.....	84					2,520	63.00	47,208	1,851
August.....	84					2,603	63.00	42,252	1,581
September.....	83	3,000	1,050			2,603	80.12	35,395	1,388
October.....	79	19,090	1,800			2,507	114.49	27,195	1,097
November.....	80	45,965	3,795	700		2,449	176.43	20,537	860
December.....	80	53,560	4,632	420			145.79	18,146	764
December.....	89	64,543	6,671	465			194.48	20,212	846
Total.....		553,193	59,693	4,937		13,370	2,003.54	370,450	14,745

HALSTAD, 1909.

January.....	89	45,247	6,626	658			191.07	29,381	1,163
February.....	88	43,520	8,544	524			211.06	29,019	1,137
March.....	75	55,114	11,222	186			266.79	34,221	1,307
April.....	84	44,850	13,515				278.15	32,895	1,235
May.....	84	26,880	9,980				191.10	40,868	1,512
June.....	77					2,582	64.05	46,926	1,759
July.....	77		500			2,387	64.05	43,264	1,615
August.....	78					2,418	58.50	43,932	1,740
September.....	79		1,860			2,370	77.64	37,121	1,498
October.....	85	18,020	4,123			2,625	133.83	26,900	1,139
November.....	85	71,080	5,640				200.54	20,040	857
December.....	84	96,595	7,487				288.05	23,394	985
Total.....		401,306	69,497	1,368		12,382	2,024.83	407,961	15,953

FINANCIAL STATEMENT OF DAIRY CATTLE.

The financial statements of the dairy enterprise on subsequent pages show the condition of the business from year to year, with the items of cost and principal sources of income given separately. All costs incurred in the dairy throughout the year have been charged and constitute the total operating expense. The charges are made up of the actual costs occurring on the farms and represent the actual sums paid out in cash and the farm price of labor and of feed used. All items are actual and not estimated, excepting charges for shelter and depreciation, which are based upon data collected, as shown on pages 22 and 23.

The total operating cost as given is the cost of operating the dairy on the basis of cash for all products fed, other cash expenditures, and labor.

Income has been classified according to the four sources of income to the farm dairy, viz, cash receipts from milk products, products used in the household, products fed, and cash sales of stock. Only three of these items can be considered as items of income dependent on the operation of the dairy herd; products used in the house represent the values of milk, butter, cream, or meat used in the farm household and have been credited at farm prices. Products fed represent the milk, whole or skimmed, used in feeding live stock on the farm (calves, hogs, poultry, etc.); its value is calculated at the rate of 15 cents per hundredweight in all years on all routes. Cash sales of stock indicate the actual cash received from all sales.

Loss or gain is the net loss or net gain below or above the entire cost of operation for the enterprise for the year.

All products from the cow have been credited to the dairy excepting calves and manure. The value of a newborn calf, whether graded or pure bred, is problematical, and should be based upon the net returns that may be obtained through raising it. Investigation has shown that on the average Minnesota farm the stock is raised at a loss; that is, the final selling price is insufficient to cover the cost of production. Whether a cow should be credited in financial statements for the calf produced is considered a matter determinable only by the actual sales made or by the returns obtained from raising this class of stock. Returns from the route farms have not been such that such a credit could be given the cows. The individual dairyman, however, may make such additions, if desirable, to show comparisons with conditions under which he may be working. Credit is not given for manure produced and used on the fields, nor is a charge made for straw used as feed or bedding. Straw, under present farm conditions in Minnesota, has no sale or exchange value.

It is recognized that manure produced and applied on the farm is a by-product from the dairy which may largely affect the profits of the farm. Its value in this State, where there is no sale for it, depends upon many factors not wholly known and in most cases wholly problematical, depending upon soil, climatic conditions, crops grown, and method of application, and, finally, to the farm operator and tenure of land. In a community where manure is not purchased and has no cash value it has not been considered best to embody a theoretical value—one which is largely intangible—in the book accounts; hence no class of stock is given credit for manure production.

Live stock and their production of manure may be considered much in the light of clover and its production of nitrogen, or grass crops and their addition of humus to the soil. The good business farmer or dairyman bears in mind the relation live stock have to the successful operation of the farm, and considers his annual financial statement from that point of view. From economic considerations, at least, it is poor business to engage in an industry requiring large investments of capital and labor if highly theoretical credits for waste products are required in order to show a profit. A farmer should be able to earn an actual money profit on his dairy enterprise from the excess of actual cash receipts and products used on the farm over and above operating expense. Only in this way can the industry be placed upon the proper business basis.

NORTHFIELD, 1905.

The dairy enterprise in 1905 at Northfield was fairly profitable. Feeds were comparatively cheap and the average price received for whole milk was slightly less (0.4 of a cent) than the cost of production. The profit was through the sale of dairy cows. A loss of \$195 or more was incurred from the operation of the dairy, but when sales of live stock are considered as a part of the enterprise the net gain for the year was \$1,247.21.

A part of these sales was miscellaneous stock, sold with the cows, and so reported that a statement of actual receipts from them was impossible. Assuming the average price for which the miscellaneous cattle were sold to be \$20 per head (probably too low), the net gain for the dairy enterprise is reduced from \$1,247.21 to \$947.21, or practically 21 per cent on the investment.

In 1905 foodstuffs (Table XX) were lower than in subsequent years of the series. The low price of feed and of labor made the cost of milk production \$104.8 cents per hundredweight. Increasing cost of feed and higher labor cost thereafter increased the cost of production from year to year.

The average production of milk per cow during 1905 was 5,358 pounds, with an average test of 3.7 per cent of butter fat.

On an average each cow consumed 6,014 pounds of roughage, 584 pounds of farm grains, 306 pounds of mill feeds, and received 174 days' pasture, making the total cost of feed per head \$25.66 a year.

Pasture was especially good this year, as precipitation was in excess of the normal. The pasture season opened about May 10 and the stubble of meadows was pastured until the latter part of October.

During 1905 pure-bred Holstein sires were introduced into practically all herds, although the milch cows at this time were largely of Shorthorn or mixed blood, of excellent record as milkers.

Financial statement.

EXPENSE.		DR.	CR.
To cash sundries (grinding feed, registration, medicines, etc.)	-----	\$96. 82	
To cash feeds (38,239 pounds bran, 442 pounds linseed-oil meal)	-----	357. 13	
To farm feeds (792,320 pounds roughage, 74,498 pounds grains, 20,862 days' pasture)	-----	2, 815. 82	
To labor (man, 16,653.5 hours; horse, 5,081.75 hours)	---	2, 100. 92	

	Dr.	Cr.
To general expense (see p. 21)-----	\$389. 83	
To shelter (average, 124 head, at \$2.46 each)-----	305. 04	
To depreciation (cows, 123½ head)-----	207. 99	
To machinery and equipment (depreciation, repairs, sundries, and interest)-----	34. 62	
To herd bulls (8 head, feed, shelter, and interest)-----	203. 68	
To interest on investment (5 per cent)-----	228. 97	

RECEIPTS.

By cash (sales of whole milk and butter fat)-----		\$6, 161. 94
By products (milk, cream, butter, and meat used in the house)-----		213. 60
By products (23,970 pounds of whole and skim milk fed)-----		170. 28
By live stock (cash sales of 21 cows and 15 heifers and calves) ¹ -----		1, 442. 21
<hr/>		
Total expense-----	6, 740. 82	
Total receipts-----		7, 988. 03
Balance-----	1, 247. 21	
<hr/>		
	7, 988. 03	7, 988. 03
Gain-----		1, 247. 21

NORTHFIELD, 1906.

The year 1906 was unfavorable to the dairy industry from a financial viewpoint on account of an increase in the cost of production, due principally to an increase in the cost of both grains and roughage and partially to the higher cost (an average of 0.5 cent per hour) of labor.

The total annual cost of maintenance per cow, \$54.39, was slightly less (28 cents) than in 1905. The cost of production increased 11 cents per hundred, due almost entirely to the decrease in quantity of product. The average yield per cow for 1906 was 4,817 pounds, a decrease of 540 pounds per cow from 1905. It is difficult to assign a reason for this decrease, excepting that changes were being made in the herds and the cows were not fed so liberally as in the preceding year.

The profit shown for the year, \$1,682.33, was entirely from the sale of stock. Sales of milk products and the products used in the household totaled \$6,831.61, or \$260.02 less than the cost of operating.

In the sales of stock, 8 head of miscellaneous stock were not separated. If the stock be considered as having a total value of \$160 the profit is reduced to \$1,522.33, all of which can be attributed directly to the sale of stock. It should be remembered that the period was one of advancing prices for stock and that many of the older cows could be sold at prices considerably in excess of their inventory value at the first of the year.

The average quantity of food fed each cow was 5,272 pounds of roughage, 418 pounds of farm grains, 308 pounds of concentrates, and 173 days of pasture. The pastures were especially good as the mean precipitation was considerably above the normal. Hay used, however, was not of so high quality as usual.

¹ Price not separated for cows and calves.

Financial statement.

EXPENSE.		Dr.	Cr.
To cash sundries (grinding feed, salt, rope, etc., -----)		\$71.33	
To cash feeds (39,167 pounds bran, 164 pounds linseed-oil meal) -----		301.80	
To farm feeds (676,868 pounds roughage, 53,886 pounds grains, 24,625 days' pasture) -----		3,118.38	
To labor (man, 17,851½ hours; horse, 5,049½ hours) -----		2,255.56	
To general expense (see p. 21) -----		267.10	
To shelter (average, 131 head, at \$2.46 each) -----		322.26	
To depreciation (cows, 130½ head) -----		257.28	
To machinery and equipment (depreciation, repairs, and interest) -----		34.32	
To herd bulls (feed, shelter, and interest, 7½ head) -----		239.95	
To interest on investment (5 per cent) -----		223.65	
RECEIPTS.			
By cash (sales of whole milk and butter fat) -----			\$6,422.65
By products (milk, butter, cream, and meat used in the house) -----			194.24
By products (whole and skim milk fed) -----			214.72
By live stock (cash sales, 24 cows, 7 heifers, 1 steer) -----			1,942.35
Total expense -----	7,091.63		
Total receipts -----		8,773.96	
Balance -----	1,682.33		
	8,773.96	8,773.96	
Gain -----			1,682.33

NORTHFIELD, 1907.

During 1906 and 1907 a decided change was taking place in the herds. The cow of uncertain breeding was being rapidly supplanted by the Holstein, and pure-bred Holstein sires were being used. In 1907 the income per cow showed a considerable increase over 1906, due primarily to the increase in the price of whole milk. The average price for the year was \$1.123 per hundredweight, compared to \$1.012 per hundred in 1906, while the cost of production decreased from \$1.159 to \$1.132 per hundredweight. This is the only year in the five in which receipts from milk products or dairy products were greater than the operating expenses. A net gain of \$282.68 was obtained through the operation of the dairy, the balance of the net gain, \$895.61, through sales of stock. Apparently, the profit from operation of the dairy was obtained because of (1) increased prices; (2) a larger proportion of the milk produced and marketed during the season of high prices; (3) a relatively high price during the season of greatest productivity.

The season was abnormal in that the mean temperatures were lower than usual, causing a late and slow growing season, although pasturage was very good. Rainfall for the year was about normal.

Smaller quantities of roughage were fed this year than in either of the preceding ones. However, a large percentage of it was hay, timothy and clover, of excellent quality. The first silo was built and filled this year and silage was fed to one herd about two months. The average quantity of food fed per cow was as follows: Roughage, 4,766 pounds; farm grains, 609 pounds; mill feeds, 239 pounds, and pasture, 157 days.

Financial statement.

EXPENSE.		Dr.	Cr.
To cash sundries (grinding feed, registration, etc.)-----		\$85. 33	
To cash feeds (26,542 pounds bran, 1,729 pounds linseed-oil meal) -----		351. 81	
To farm feeds (559,275 pounds roughage, 72,854 pounds grains, 17,747 days' pasture)-----		2, 788. 22	
To labor (man, 14,052 hours; horse, 3,169 $\frac{3}{4}$ hours)-----		1, 904. 15	
To general expense (see p. 21)-----		165. 34	
To shelter (average, 116 head, at \$2.46 each)-----		285. 36	
To depreciation (cows, 115 $\frac{5}{12}$ head)-----		210. 35	
To machinery and equipment (depreciation, repairs, and interest) -----		70. 60	
To herd buils (feed, shelter, and interest, 7 head)-----		246. 22	
To interest on investment (5 per cent)-----		240. 30	
RECEIPTS.			
By cash (sales of whole milk and butter fat)-----		\$6, 198. 74	
By products (milk, cream, butter, and meat used in house)-----		291. 40	
By products (77,384 pounds of skim and whole milk fed)-----		140. 22	
By live stock (cash sales, 24 cows)-----		895. 61	
		<hr/>	
Total expense-----		6, 347. 68	
Total receipts-----			7, 525. 97
Balance -----		1, 178. 29	
		<hr/>	
		7, 525. 97	7, 525. 97
Gain -----			1, 178. 29

NORTHFIELD, 1908.

The year 1908 was marked by a decided increase in the annual cost of maintenance of a cow over that of the previous year. The increase, 32 per cent, was made up of increased cost of feed, 19 per cent; increased labor cost, 39 per cent; and 82 per cent increase in depreciation and interest, due to the higher value of cows in the herd. Increases in the cost of feed were due primarily to the higher cost of grain and mill feed. Although a larger quantity of roughage was fed during this than the previous year, lower prices and the fact that the silage fed increased quantities materially did not noticeably increase its cost. Two more silos were constructed on the route this year, enabling three of the seven herds to be fed silage.

The decided increase in cost of maintenance was reflected in the cost of milk production. Although the average production of milk per cow rose to 5,659 pounds for the year, the cost increased to \$1.321 per hundredweight. At the same time the average price paid for milk rose to \$1.23 per hundred, leaving a net loss of 9 cents per hundredweight of milk. The year shows the widest margin between cost of production and price received of any year excepting 1906, when the difference was 14.7 cents.

Despite the comparatively low price of milk, the enterprise as a whole showed the marked gain of \$2,377.33, all of which, however, was due to the sale of stock and the increased valuation. Such rises in value make for the prosperity only of those individuals engaged in the sale of stock or who are in position to profit by the increases in valuation. To the great mass of dairymen higher values of live stock without proportionate increases in production means loss. In other words, the great majority of dairymen show profit

or loss on their dairy enterprise as price of product shows increases or losses compared to the cost of production. These men have to make their entire profits from the product sold.

The year 1908 was almost normal, and no great variation in conditions which might affect the dairy industry were noted. The average price at which roughage was fed was slightly lower than the previous year.

Financial statement.

EXPENSE.		DR.	CR.
To cash sundries (salt, registration, transfers, medicines, etc.)	-----	\$108.73	
To cash feeds (1,000 pounds sugar feed, 35,434 pounds bran, 9,613 pounds linseed-oil meal)	-----	564.06	
To farm feeds (684,848 pounds roughage, 45,463 pounds grains, 17,096 days' pasture)	-----	2,837.32	
To labor (man, 14,315 hours; horse, 3,452 hours)	-----	2,404.58	
To general expense (see p. 21)	-----	364.74	
To shelter (average, 105 head, at \$2.46 each)	-----	258.30	
To depreciation (cows, 105½)	-----	472.56	
To machinery and equipment (depreciation, repairs, and interest)	-----	103.86	
To herd bulls (interest, feed, and shelter, 6 head)	-----	222.76	
To interest on investment (5 per cent)	-----	273.40	
RECEIPTS.			
By cash (sales of whole milk and butter fat)	-----	\$6,383.62	
By products (milk, cream, butter, and meat used in house)	-----	199.71	
By products (64,625 pounds of whole and skim milk fed)	-----	207.67	
By live stock (cash sales, 32 cows)	-----	2,893.15	

Receipts from operation	-----		9,684.15
By live stock (value increased by appreciation)	-----		303.50

Total expense	-----	7,610.31	
Total receipts	-----		9,987.65
Balance	-----	2,377.34	

		9,987.65	9,987.65
Gain	-----		2,377.34

NORTHFIELD, 1909.

The year 1909 was one of abundant crops of both hay and grain. Pastures continued good. Rainfall was about normal and excellent pasture was furnished throughout the season. The cost of production was materially decreased by lower cost of feeds and labor. Based on a whole-milk product of 5,434 pounds per cow, the average cost of production was \$1.269 per hundredweight. There was a slight increase in milk prices, the average for the year being \$1.25 per hundred, leaving a margin of loss of 1.9 cents per hundredweight. Considering the dairy business in the light of the sale of dairy products, a loss of \$224 was made. The enterprise as a whole, however, showed an excellent profit of \$3,958.83, or 43 per cent on the investment at the opening of the year. This profit was entirely from large sales of stock at remunerative prices, the average being over \$110 per head.

Grain, mill feed, and especially roughage show a marked decrease in cost from 1907. A greater quantity of silage was fed and a larger

percentage of the cows was fed silage than in any former year, as is shown by the increased quantity of roughage fed each cow.

A peculiar condition appears this year, viz., notwithstanding heavier feeding (6,345 pounds of roughage and 1,013 pounds of grain and mill feed per cow) than in any former year, the yield of milk per cow—5,434 pounds—is less than in 1908. The only explanation of this decrease in production is that a large number of heifers were taken into the herd while a larger number of good cows than usual were sold, thus reducing the average production per cow. Many of the cows sold were the best producers in the herd, and the heifers, while excellent animals, could not replace in productivity the matured stock sold.

Financial statement.

EXPENSE.		DR.	CR.
To cash sundries (veterinary, butchering, registration, etc.)-----		\$73. 63	
To cash feeds (33,609 pounds bran, 4,358 pounds linseed-oil meal)-----		533. 62	
To farm feeds (674,942 pounds roughage, 67,347 pounds grain, 15,878 days' pasture)-----	2, 237. 09		
To labor (man, 12,925 hours; horse, 3,665 hours)-----	2, 117. 56		
To general expense (see p. 21)-----	274. 57		
To shelter (average, 103 head, at \$2.46 each)-----	253. 38		
To depreciation (cows, 103)-----	694. 73		
To machinery and equipment (depreciation, repairs, and interest)-----	92. 63		
To herd bulls (interest, feed, and shelter, 7 head)-----	233. 22		
To interest on investment (5 per cent)-----	424. 05		
RECEIPTS.			
By cash (sales of whole milk and butter fat)-----		\$6, 027. 64	
By products (milk, cream, butter, and meat used in house)-----		244. 77	
By products (77,810 pounds whole and skim milk fed)-----		438. 08	
By live stock (cash sales, 38 cows)-----		4, 182. 82	
Total expense-----	6, 934. 48		
Total receipts-----		10, 893. 31	
Balance-----	3, 958. 83		
	10, 893. 31	10, 893. 31	
Gain-----		3, 958. 83	

MARSHALL, 1906.

On account of errors in the reports for 1905 the year 1906 was the first one for which accurate, full, and continuous records were obtained. Situated in the southwestern part of the State, in an area of rich rolling land, the Marshall route lies in a section in which the dairy industry, it would seem, should be carried on profitably. But many obstacles have made it difficult to build up the industry to any extent. Among these is the lack of cooperative creameries; lower prices than in successful dairy localities; larger farms and a comparatively greater interest in the feeding of live stock than in the dairy industry. During the years specified little change has taken place in the class of stock kept on the farms except that an effort has been made to select the more productive cows.

After 1907 the data given is hardly comparable to those given for the other routes, or for 1906 and 1907 at Marshall. At that time the route was moved into an adjacent territory in which the growing and feeding of live stock was the leading cattle enterprise rather than dairying.

The rainfall was very heavy this year, consequently large areas were devoted to pasture. The largest percentage of the pasture area had originally been sown to tame grass, timothy, but this was pretty well exhausted through the process of time. While pasture was abundant, the quality was not so high as at Northfield.

The average yield of milk per cow was 3,378 pounds carrying 3.8 per cent of butter fat. The enterprise for the year shows a net loss of \$145.55 or 8.6 per cent on the investment. The cost of production of a pound of butter fat was 33.3 cents and of a hundredweight of milk 126.6 cents.

Financial statement.

EXPENSE.		DR.	CR.
To cash sundries (salt, grinding feed, etc.)	-----	\$19. 80	
To cash feeds (1,756 pounds bran and shorts)	-----	8. 43	
To farm feeds (178,362 pounds roughage, 54,961 pounds grains, 9,071 days' pasture)	-----	982. 57	
To labor (man, 5,466 $\frac{3}{4}$ hours; horse, 999 $\frac{1}{2}$ hours)	-----	717. 01	
To general expense (see p. 21)	-----	80. 59	
To shelter (average, 53 head, at \$2.46 each)	-----	130. 38	
To depreciation (cows, 52 $\frac{1}{2}$ head)	-----	18. 93	
To machinery and equipment (depreciation, repairs, and interest)	-----	11. 91	
To herd bulls (interest, shelter, and feed, 3 head)	-----	74. 63	
To interest on investment (5 per cent)	-----	84. 25	
RECEIPTS.			
By cash (sales of whole milk and butter fat)	-----		\$721. 99
By products (milk, cream, butter, and meat used in the house)	-----		604. 38
By products (112,574 pounds whole and skim milk fed)	-----		233. 89
By live stock (cash sales, 16 cows)	-----		422. 69
Total expense	-----	2, 128. 50	
Total receipts	-----		1, 982. 95
Balance	-----		145. 55
		2, 128. 50	2, 128. 50
Loss	-----	145. 55	

MARSHALL, 1907.

Temperatures during the crop season were lower than normal this year, retarding corn planting until the first part of June and causing slow, weak growth of the plants. Precipitation was very heavy during the spring and early summer, flooding much of the lowland devoted to pasture, and curtailing the acreage growing good pasture grasses. However, pasture was good throughout the season, and the hay and fodder corn was fair.

Slight changes were made on the route farms this year. These changes in conjunction with closer selection of productive animals and better rations resulted in an increased average production per cow. The average yield of milk per cow was 3,623 pounds, carrying 4 per cent fat. The cost of maintenance for the year increased by

25 per cent, due to higher cost of feeds and larger quantity of grain fed. A large quantity of roughage and grain was fed partly on account of the shorter pasture season—16 days less than the previous year—but chiefly because of a growing desire to obtain more nearly a maximum production. This is reflected in increased care and feed provided. Labor cost also increased this year.

Based on the total production of whole milk, butter fat was produced at a cost of 37.7 cents per pound and whole milk at \$1.507 per hundredweight. The result was a loss of \$522.70 for the dairy enterprise, or a net loss of almost 32 per cent on the investment at the opening of the year.

Financial statement.

EXPENSE.		Dr.	Cr.
To cash sundries (salt, dehorning, etc.)-----		\$10. 43	
To cash feeds (9,786 pounds bran, 180 pounds linseed-oil meal)-----		101. 47	
To farm feeds (264,241 pounds roughage, 64,079 pounds grains, 10,105 days' pasture)-----	1, 358. 91		
To labor (man, 6,783 hours; horse, 1,036 hours)-----	1, 030. 73		
To general expense (see p. 21)-----	133. 80		
To shelter (average, 61 head, at \$2.46 each)-----	150. 06		
To depreciation (cows, 60½ head)-----	20. 91		
To machinery and equipment (depreciation, repairs, and interest)-----	39. 97		
To herd bulls (shelter, feed, and interest, 6 head)-----	177.41		
To interest on investment (5 per cent)-----	85. 97		
RECEIPTS.			
By cash (sales of whole milk and butter fat)-----		\$1, 102. 36	
By products (milk, cream, butter, and meat used in the house)-----			793. 92
By products (145,827 pounds of whole and skim milk fed)-----			252. 91
By live stock (cash sales, 12 cows)-----			437. 77
Total expense-----	3, 109. 66		
Total receipts-----		2, 586. 96	
Balance-----			522. 70
	3, 109. 66	3, 109. 66	
Loss-----	522. 70		

MARSHALL, 1908.

In 1908 the route was changed from farms on the east to farms on the west side of Marshall and was located principally among farmers interested in growing and feeding live stock. No particular effort was made on these farms to carry on the dairy enterprise, except that certain good producing cows were milked for home use and the surplus butter fat sold. Under this condition it was considered best to present the data from only two herds which were used as farm dairies. The results from only two farms are shown in 1908 and 1909. These results, because of the smaller number of farms, are not comparable with the averages obtained on the other routes nor are they given equal weight.

The pastures on the farms under consideration were of rather poor tame grass. The acreage was sufficient to allow of full pasturage during the greater part of the season. After the crops were

off the stock grazed over the stubble and in the cornfields. A large amount of pasture was secured in this way, saving a considerable quantity of roughage. Referring to the annual food consumption in 1908, in comparison with 1906 and 1907, it should be noted that no roughage was fed during June, July, August, September, and October, and that very little was fed in May and November, while in the former years roughage and grain were fed throughout the season. This materially decreased the cost of feeds and apparently kept up a flow of milk sufficient to more than cover the cost of production. The fact that a small profit was made each year from this method of management in spite of a comparatively low average yield would indicate that there is merit in it.

The labor cost for the years 1908 and 1909 is lower than the previous average. This may be partially accounted for by the fact that these farms are located near town and that in many cases their product was purchased directly at the farm, thereby saving the cost of marketing.

The average yield per cow was 4,840 pounds of milk containing 4.3 per cent of butter fat. At the low cost of maintenance per cow, \$43.90 per annum, butter fat was produced at a cost of 22.7 cents per pound and whole milk at 97.4 cents per hundredweight. The net profit for the year was \$176.79, of which \$40.59 was obtained entirely from the dairy products, the remaining profit being due to increase in value.

Financial statement.

EXPENSE.		Dr.	Cr.
To cash sundries (salt, veterinary, etc.)	-----	\$8. 60	
To cash feeds (4,200 pounds bran)	-----	46. 28	
To farm feeds (66,903 pounds roughage, 10,677 pounds grains, 3,928 days' pasture)	-----	379. 89	
To labor (man, 1,504 hours; horse, 277 hours)	-----	239. 87	
To general expense (see p. 21)	-----	24. 60	
To shelter (average, 19 head, at \$2.46 each)	-----	46. 74	
To depreciation (cows, 18½ head)	-----	6. 45	
To machinery and equipment (depreciation, repairs, and interest)	-----	18. 40	
To herd bulls (feed, shelter, interest, 1 head)	-----	30. 36	
To interest on investment (5 per cent)	-----	24. 80	
RECEIPTS.			
By cash (sales of whole milk and butter fat)	-----		\$583. 40
By products (milk, butter, and cream used in the house)	-----		144. 68
By products (61,892 pounds of whole and skim milk fed)	-----		138. 50
By live stock (cash sales, 5 cows)	-----		136. 20
Total expense	-----	825. 99	
Total receipts	-----		1, 002. 78
Balance	-----	176. 79	
		1, 002. 78	1, 002. 78
Gain	-----		176. 79

MARSHALL, 1909.

The same two herds were continued in 1909 as in 1908 under practically the conditions noted for that year. The crop season, both as to temperature and rainfall, was more propitious than in 1908. Pas-

tures were good throughout the season, although the cows were not out so late or turned out so early as in 1908. This resulted in the feeding of a greater quantity of roughage, although the grain fed was lessened. Cost increased this year chiefly on account of higher labor cost and increased charges for general expense and machinery and equipment.

The average yield per cow decreased, probably on account of the smaller grain rations fed. A higher cost of maintenance combined with a decrease in production increased the cost of milk production to \$1.11 per hundredweight and of butter fat to 30 cents per pound. The feeds used remained about the same price as in 1908.

Financial statement.

EXPENSE.	Dr.	Cr.
To cash sundries (salt, etc.)-----	\$3. 50	
To cash feeds (6,000 pounds bran)-----	68. 95	
To farm feeds (74,191 pounds roughage, 6,742 pounds grains, 3,873 days' pasture)-----	346. 22	
To labor (man, 1,392 hours; horse, 732 hours)-----	277. 15	
To general expense (see p. 21)-----	57. 72	
To shelter (average, 19 head, at \$2.46 each)-----	46. 74	
To depreciation (cows, 18½ head)-----	7. 49	
To machinery and equipment (depreciation, repairs, and interest)-----	37. 25	
To herd bulls (feed, shelter, and interest, 1 head)-----	31. 96	
To interest on investment (5 per cent)-----	25. 80	
RECEIPTS.		
By cash (sales of whole milk and butter fat)-----		\$729. 53
By products (milk, cream, and butter used in the house)-----		89. 60
By products (46,509 pounds of whole and skim milk fed)-----		131. 39
By stock (cash sale, 1 cowhide)-----		4. 75
Total expense-----	902. 78	
Total receipts-----		955. 27
Balance-----	52. 49	
	955. 27	955. 27
Gain-----		52. 49

HALSTAD, 1904.

The results of the dairy enterprise for this and subsequent years show well the conditions and difficulties that beset the farmer in the newer dairy regions. Most, if not all, of them arise from lack of knowledge of proper methods of feed and care and of an appreciation of their influence upon production. A striking example is shown at Halstad of continued improvement year after year and of the application of improved methods to the dairy in ordinary farm practice.

The figures are the more valuable from the fact (1) that they begin the year following the inception of the dairy industry in that section of the Red River Valley and (2) that accounts have been kept in one case for the same farm, and in all cases for the same type of farm, continuously.

Due to the distance from market the farm value of roughage is low; in many cases the live stock on the farm constituted the only

possible way of utilization. Therefore the cost of maintenance is relatively low as compared with the sections more favorably located as to markets.

Pastures were either wild grass or timothy that had been seeded for some time. The grazing on such pastures was invariably short in August, after the summer rains had discontinued, and was never so luxuriant as that on the tame-grass pastures in the more humid areas.

The cost of maintenance per cow was \$42.21, and the average yield was 3,546 pounds of milk, carrying 3.9 per cent of butter fat. The yield was approximately 500 pounds below the average of the State at that time. It would follow that with relatively low yields, even though the cost of maintenance was low, the cost of milk or butter-fat production would be high. Based on total yield, the cost of producing milk was \$1.241 per hundredweight and of butter fat 31.8 cents per pound.

Each cow was fed 5,290 pounds of hay (either wild or timothy), 635 pounds of farm grains, principally oats and barley, 15 pounds of mill feeds, and received 168 days of pasturage.

The crops were injured very much this year by the attack of black rust that materially reduced yields and made the grain low in quality and natural weight.

Financial statement.

EXPENSE.	Dr.	Cr.
To cash sundries-----	\$9. 17	
To cash feeds (1,000 pounds bran, 200 pounds shorts)-----	7. 60	
To farm feeds (354,690 pounds roughage, 42,779½ pounds grains, 11,742 days' pasture)-----	1, 156. 84	
To labor (man, 8,497 hours; horse, 1,255 hours)-----	1, 096. 69	
To general expense (see p. 21)-----	165. 13	
To shelter (average, 68 head, at \$2.46 each)-----	167. 28	
To depreciation (cows, 68½ head)-----	20. 56	
To machinery and equipment (depreciation, repairs, and interest)-----	21. 20	
To herd bulls (feed, shelter, and interest, 6 head)-----	125. 76	
To interest on investment (6 per cent)-----	97. 24	
RECEIPTS.		
By cash (sales of whole milk and butter fat)-----		\$826. 83
By products (milk, cream, butter, and meat used in the house)-----		626. 48
By products (159,315 pounds of whole and skim milk fed)-----		290. 59
By live stock (cash sales, 8 cows)-----		181. 25
Total expense-----	2, 867. 47	
Total receipts-----		1, 925. 15
Balance-----		942. 32
	2, 867. 47	2, 867. 47
Loss-----	942. 32	

HALSTAD, 1905.

The entire growing season was characterized by frequent and heavy rains. A late snow in April caused the opening of the pasture season to be delayed until late May. Pastures were good and grazing abundant, however, throughout the rest of the season.

The cost of maintenance increased slightly over that of the previous year, although the expenditures for feeds were less, due partly to lower values and partly to a decrease in the quantity of grain fed.

The average quantity of milk produced per cow increased to 3,887 pounds, testing 3.9 per cent of butter fat. This increase was sufficient to reduce the cost of producing butter fat to 29.9 cents per pound and of whole milk to \$1.169 per hundredweight. Economy in the cost of production was reflected in the lessened loss from the dairy enterprise. Average price received for butter fat increased 1.6 cents per pound for the year, while the cost of production decreased 1.9 cents per pound.

Financial Statement.

EXPENSE.		DR.	CR.
To cash sundries.....		\$7. 90	
To cash feeds (199.2 pounds of bran, rental of pasture, \$10)		12. 30	
To farm feeds (319,515 pounds roughage, 31,189 pounds grains, 7,869 days' pasture).....		838. 10	
To labor (man, 6,714 hours; horse, 969½ hours).....		830. 51	
To general expense (see p. 21).....		125. 70	
To shelter (average, 53 head, at \$2.46 each).....		130. 38	
To depreciation (cows, 53½ head).....		14. 92	
To machinery and equipment (depreciation, repairs, and interest)		77. 62	
To herd bulls (feed, shelter, and interest, 8 head).....		154. 68	
To interest on investment (6 per cent).....		84. 33	
RECEIPTS.			
By cash (sales of whole milk and butter fat).....			\$704. 13
By products (milk, cream, butter, and meat used in the house)			732. 02
By products (124,124 pounds whole and skim milk fed).....			229. 13
By live stock (cash sales, 11 cows).....			255. 75
Total expense.....	2, 276. 44		
Total receipts.....		1, 921. 03	
Balance		355. 41	
	2, 276. 44	2, 276. 44	
Loss	355. 41		

HALSTAD, 1906.

The farming operations for the year were practically a failure because of the heavy rainfall of the previous year and because heavy rains in the spring made it impossible to work the land. Nearly all feed grains were purchased and shipped in, but nevertheless the cows were more liberally fed than in the previous years.

Owing to poor crops cash receipts from the farms were very low, so the income from the cows was of importance in carrying on the various farm operations.

The pasture season was shortened, owing to the late spring and early winter, to 124 days. Pasturage, however, was very fair during the entire season.

The cost of milk production and of butter fat was increased slightly by the increasing cost of maintenance per cow. Butter fat sold during the year showed only a slight average increase—one-half cent per pound over the previous year—which was not commensurate with the increased cost of production. A gross loss of \$955.06 was the net result for the year, due mostly to the difference between the cost of production and price received, although an increased produc-

tion per cow would have aided materially in decreasing the cost per unit of product.

A couple of Guernsey bulls were obtained and used in the herds this year; also several of the less productive cows were disposed of.

Financial statement.

EXPENSE.	DR.	CR.
To cash sundries.....	\$46. 50	
To cash feeds (5,325 pounds bran).....	37. 49	
To farm feeds (562,524 pounds roughage, 85,312 pounds grains, 14,463 days' pasture).....	1, 666. 71	
To labor (man, 13,237 hours; horse, 2,175 hours).....	1, 666. 42	
To general expense (see p. 21).....	255. 74	
To shelter (average 94 head, at \$2.46 each).....	231. 24	
To depreciation (cows, 94 head).....	28. 84	
To machinery and equipment (depreciation, repairs, and interest).....	71. 15	
To herd bulls (feed, shelter, and interest, 9 head).....	206. 04	
To interest on investment (6 per cent).....	148. 47	
RECEIPTS.		
By cash (sales of whole milk and butter fat).....		\$1, 954. 10
By products (milk, cream, butter, and meat used in the house).....		644. 22
By products (233,585 pounds whole and skim milk fed).....		437. 72
By live stock (cash sales, 14 head).....		367. 50
Total expense.....	4, 358. 60	
Total receipts.....		3, 403. 54
Balance.....		955. 06
	4, 358. 60	4, 358. 60
Loss.....		955. 06

HALSTAD, 1907.

The year 1907 was normal in almost every respect although the growth of grass in the spring was backward. Stock was not turned on pasture until the first part of June, but was continued thereon until late October. A comparatively large quantity of bran was fed in the early part of the year, due to the scarcity of farm grains. All foodstuffs were slightly higher than in the previous year, which resulted, in spite of increasing economy in feeding, in a higher cost of feed for the year than in 1906.

Excellent crops of clover and timothy hay were secured which helped to make the returns more economical. However, lack of liberality in rations resulted in a decrease in the milk yield. This, with the very decided increase in the cost of maintenance increased the cost of production of butter fat by almost 1 cent a pound. The price paid for butter fat showed a decided increase for the year, over 3 cents, leaving a margin of less than 9 cents between cost of product and its sale price.

The financial results for the year showed a net loss of \$690.97, the greater part of which was due to the difference between cost of production and price received. During the year culling of the herds continued; several cows were disposed of and 19 heifers were added to the herd.

Financial statement.

EXPENSE.	DR.	CR.
To cash sundries.....	\$60. 30	
To cash feeds (11,897 pounds bran).....	97. 60	
To farm feeds (429,151 pounds roughage, 62,938 pounds grains, 14,306 days' pasture).....	1, 688. 33	
To labor (man, 13,710 hours; horse, 1,975 hours).....	1, 734. 19	
To general expense (see p. 21).....	157. 16	
To shelter (average, 93 head, at \$2.46 each).....	228. 78	
To depreciation (cows, 93 head).....	26. 96	
To machinery and equipment (depreciation, repairs, and interest)	89. 51	
To herd bulls (feed, shelter, and interest, 8 head).....	192. 62	
To interest on investment (6 per cent).....	139. 17	
RECEIPTS.		
By cash (sales of whole milk and butter fat).....		\$2, 069. 02
By products (milk, cream, butter, and meat used in the house)		672. 48
By products (161,033 pounds whole and skim milk fed).....		350. 81
By live stock (cash sales, 22 head).....		631. 34
Total expense.....	4, 414. 62	
Total receipts.....		3, 723. 65
Balance		690. 97
	4, 414. 62	4, 414. 62
Loss.....	690. 97	

HALSTAD, 1908.

Climatic conditions throughout the year were normal, crops excellent, and feed abundant. The pasture season extended from the latter part of May until the last of October, a season of 162 days, which is slightly over the normal. Grass was good excepting a short time in August when pastures were dry. Practically all the roughage fed was tame hay, timothy and clover, and corn fodder. The cows were fed liberally and responded well. The average yield of milk per cow was 4,399 pounds, carrying 178 pounds of butter fat.

The feeding of a heavier ration and the increasing cost of roughage and grain used, and cost of labor, resulted in a decided increase in maintenance costs. The loss on the entire enterprise, however, for the year was \$998.49. An increased milk yield even at a higher cost resulted in practically maintaining the cost of production at the level of the previous year.

Financial statement.

EXPENSE.	DR.	CR.
To cash sundries.....	\$32. 58	
To cash feeds (4,937 pounds mixed mill feeds).....	59. 24	
To farm feeds (553,193 pounds roughage, 59,693 pounds grains, 13,370 days' pasture).....	1, 944. 30	
To labor (man, 11,465 hours; horse, 1,068 hours).....	1, 605. 36	
To general expense (see p. 21).....	233. 15	
To shelter (average, 84 head, at \$2.46 each).....	206. 64	
To depreciation (cows, 84½ head).....	24. 69	
To machinery and equipment (depreciation, repairs, and interest).....	67. 91	
To herd bulls (feed, shelter, and interest, 9 head).....	235. 56	
To interest on investment (6 per cent).....	131. 82	

